# Annotated Bibliography of the Bauxite Deposits of the World

GEOLOGICAL SURVEY BULLETIN 999

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*By* ELIZABETH C. FISCHER

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# ANNOTATED BIBLIOGRAPHY
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# BAUXITE DEPOSITS OF THE WORLD

By Elizabeth C. Fischer

## INTRODUCTION

This bibliography is the outgrowth of a card index of the more important publications on bauxite deposits that was prepared by Mrs. Martha S. Carr between 1936 and 1939 for the use of staff members of the U. S. Geological Survey. The greatly increased demand for aluminum caused by World War II brought a large increase in the number of requests to the Geological Survey for information on bauxite, from various defense agencies and from private companies and individuals. In order to facilitate the answering of these requests, Mrs. Carr prepared a small list of important papers on this subject for general distribution.

In December 1942 the work of enlarging the original card file was begun by Mrs. Helen S. Earhart, and about three months later the project was transferred to the writer. Josiah Bridge and Mackenzie Gordon, Jr., who were engaged in bauxite investigations for the Geological Survey, cooperated closely during preparation of the bibliography and contributed many helpful suggestions that have increased the usefulness and scope of the compilation. Mr. V. L. Skitsky, also of the Geological Survey, offered invaluable assistance with many of the Russian names and titles.

The present volume consists of annotated references to papers on bauxite deposits of the world, with particular reference to their origin, mineralogy, stratigraphic position, physiographic setting, reserves, and production. The citations are arranged in alphabetical order of authors' names. An index and cross-reference system by subject and geographic location is included.

The bibliography contains more than 1,000 references, includes papers through December 31, 1950, and is as complete as it is possible to make it with the facilities available in Washington, D. C. The number of papers dealing with bauxite deposits of the United States is much greater than of any foreign country and is probably much more complete. This is due to (1) the very complete coverage of the literature in the Bibliography of North American Geology, and (2) the fact that not all of the foreign publications are obtainable in the Library of the Geological Survey or the Library of Congress. The

latter condition was caused by the disruption of the International Exchange Service during the war, a service not fully restored to date.

The following bibliographies were used in preparing this compilation:

Bibliography of North American Geology, 1785–1950: U. S. Geol. Survey Bulls. 746, 747, 823, 937, 938, 949, 952, 958, 968, 977, and 985.

List of Geologic Literature added to the Geological Survey Library (London), annually, 1894–1934.

Bibliography and Index of Geology, Exclusive of North America, Geol. Soc. America. Bull., v. 1–14, 1933–1950.

Annotated Bibliography of Economic Geology, semi-annually, 1928–1950.

Other titles were obtained from the lists of references and footnotes appearing in many publications, and from a systematic check of the new books received each week by the U. S. Geological Survey Library.

A number of papers on laterite and laterization have been included in this work because these terms as used by many authors are synonymous with bauxite and the processes active in its formation. However, because much of what has been called laterite is not bauxite, not all papers on laterite and its formation have been included.

A few papers on soils and soil formation in tropical and subtropical regions are also included because of their contribution to the problem of rock weathering, for it is now recognized that certain processes in soil formation are also important in the formation of bauxite.

Papers dealing with the technical aspects of mining, processing, and uses of bauxite and those dealing with aluminum metal have been omitted, unless they also contain information concerning the location, geology and mineralogy, or reserves of the deposits. The "Current Events" columns of many of the technical journals often contain brief notes and "scout reports" on discoveries, mining activities, production at various deposits, and changes of ownership. Most of these are anonymous contributions and, although interesting at the time of publication, are of little permanent value. In general, these have also been disregarded, unless the information in them is of more than passing interest.

Most definitions of bauxite are based on two ideas: (1) the predominance of an aluminum hydroxide in the material, and (2) its value as an ore of aluminum. The physical characteristics of bauxite are extremely variable. Although the bauxite commonly seen in the United States and elsewhere is red to white in color, hard to soft, and generally pisolitic in texture, it may be white and textureless; it may resemble a red clayey soil, as in Jamaica; or it may be hard, compact, and schistose as, for example, the bauxite and emery deposits of

Greece. The mineralogic characteristics of bauxite are more simple, the aluminum occurring primarily as gibbsite (aluminum trihydrate, hydrargillite), or as boehmite or diaspore. Impurities in bauxite are primarily kaolinite, halloysite, hematite, goethite, siderite, and titanium minerals. Silica, present in kaolinite or halloysite, is the most serious impurity in bauxite to be used for the production of aluminum; in the Bayer process it combines with alumina in the ratio of approximately 1:1.1, and, with soda in a similar proportion, forms an insoluble compound, sodium aluminum silicate, thereby reducing the amount of recoverable or "available" alumina. Because of this, material containing more than 7 percent silica was not considered to be ore in the United States prior to 1940 or, if used, was subject to penalties for each additional percent of silica. During World War II, however, improvements in the refining process permitted the use of material containing higher percentages of silica, and at present some plants can successfully treat bauxite containing an average of 15 percent of silica. The other impurities are inert in the refining process. Small percentages of columbium and gallium are found in some bauxites and constitute an important potential by-product. Titanium, relatively high in bauxites such as those of India, will also be a valuable by-product when an extraction process has been perfected. Specifications for bauxite used for purposes other than the manufacture of aluminum vary with the nature of the product.

The locations of the major bauxite deposits of the world are shown on a small scale map, plate 1. Most of these are concentrated in a zone extending about 20 degrees on each side of the equator. The deposits consisting primarily of gibbsite occur for the most part in the humid tropical and subtropical regions such as the Caribbean area (British Guiana, Surinam, Jamaica, Hispaniola), Brazil, northern and central Africa, southern Asia, and some of the islands of the western Pacific, as well as in regions such as the southern United States where the temperatures were presumably warmer during the comparatively recent period (early Tertiary) in which the bauxite was formed.

The deposits in which boehmite is the predominant mineral are concentrated somewhat farther north, particularly in the Mediterranean region of southern Europe (Spain to Turkey), and are most abundant in rocks of Mesozoic age.

Deposits of diaspore lie still farther to the north, commonly associated with rocks of Paleozoic age; or else they occur in regions that have undergone deformation and some metamorphism. The largest of the diaspore deposits are found in China, U. S. S. R., and the northern tip of Hungary; very small deposits are found in the United States in Pennsylvania and Missouri.

Thus the mineralogic composition of the bauxite deposits has a rough zonal arrangement: gibbsite is most abundant in an equatorial zone; boehmite predominates to the north of this zone in southern Europe and western Asia; and diaspore occurs still farther to the north.

Some notable exceptions to this generalization are the gibbsitic bauxites of Oregon, Ireland, Scotland, Germany, certain areas in Hungary, and Australia. The deposits of diaspore in Greece and Turkey also occupy a somewhat anomalous position, geographically and stratigraphically, and indicate the complexity of factors involved in the formation of bauxites.

In setting up the bibliography a standard form has been used. The citations consist of (1) the author's name, with alternate spellings in parentheses; (2) the title of the paper, quoted in each language in which it appears on the title page, or the title of the paper and its summary if these are all printed together; and (3) the name of the periodical in abbreviated form, volume, number, pages, number of illustrations, and date; or for a book, the pages, illustrations, place of publication, publisher, and date. Exceptions are citations to Chinese and Japanese publications, reference to which omits the native language, or to a publication in another of the less familiar languages, in which instance a translation is enclosed in brackets. Russian names and titles have been transliterated by the system of the Board on Geographic Names, adopted in 1944. The annotations, have been prepared by the writer. A few annotations have been copied from two of the bibliographies listed above. Each quoted annotation is followed by a credit note, in which an asterisk (*), indicating the source to be the "Bibliography of Geology Exclusive of North America," or a dagger (†), indicating the source to be the "Annotated Bibliography of Economic Geology," is followed by the volume, number, and year. Geographic and geologic names that appear in the annotations, are those employed by the individual authors and their use here does not imply approval by the Board on Geographic Names or the Geological Survey.

The following list gives both the abbreviated form and the full name of the periodicals and serials to which reference is made in the bibliography. The place of publication is also given.

## SERIALS

| *Abbreviation* | *Publication* |
|---|---|
| (R.) Acad. cienc. Barcelona Mem | (Real) Academia de ciencias y artes de Barcelona, Memorias. |
| (R.) Acad. cienc. exactas Madrid Mem.; Rev. | (Real) Academia de ciencias exactas físicas y naturales de Madrid, Memorias; Revista. |
| Acad. sci. Paris Comptes rendus | Académie des sciences, Paris, Comptes rendus hebdomadaires des séances. |
| Acad. Tchèque sci. Bull. internat | Académie Tchèque des sciences (Česká akademie vědomí a umění), Bulletin international, résumés des travaux présentés. Prague. |
| Acad. Yougoslave sci. Bull. internat | Academie Yougoslave des sciences et des beaux-arts, Bulletin international. Zagreb. |
| (R.) Accad. naz. Lincei, Cl. sci. fis., mat. e nat. Atti; Rend. | (Real) Accademia nazionale dei Lincei, Classe di scienze fisiche, matematiche e naturali, Atti; Rendiconti. Rome. |
| Accad. sci. veneto-trentino-istriana Atti; Bull. | Accademia scientifica veneto-trentino-istriana, Atti; Bulletino. Padua. |
| Akad. Athēnōn Prakt | Akademia Athēnōn, Praktica. Athens. |
| Akad. nauk SSSR Doklady; Trudy; Izv., Ser. geol. | Akademiya nauk SSSR, Doklady; Trudy; Izvestiya, Seriya geologicheskaya (Académie des sciences de l'URSS, Comptes rendus; Bulletin, Série géologique). Leningrad-Moscow. |
| Akad. nauk SSSR, Petrog. inst. Trudy | Akademiya nauk SSSR, Petrograficheskiy institut, Trudy (Académie des sciences de l'URSS, Institut petrographique, Travaux.) Leningrad. |
| Akad. Wiss. Wien, Math-nat. Kl. Anz.; Sitzungsber. Abt. 1. | Akademie der Wissenschaften in Wien, Mathematisch-naturwissenschaftliche Klasse, Anzeiger; Sitzungsberichte, Abteilung 1, Mineralogie, Biologie, Erdkunde. |
| Ala. Acad. Sci. Jour | Alabama Academy of Science Journal. Birmingham. |
| Ala. Geol. Survey Bull.; Circ.; Special Rept. | Alabama Geological Survey, Bulletin; Circular; Special Report. Tuscaloosa. |
| Ala. Indus. Devel. Board | Alabama Industrial Development Board. Montgomery. |
| Ala. Indus. Sci. Soc | Alabama Industrial and Scientific Society. Tuscaloosa. |
| Allied Powers GHQ Tokyo, Nat. Res. Sec. Prelim. Study. | Supreme Commander for the Allied Powers, General Headquarters, Tokyo, Natural Resources Section, Preliminary Study. |

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| Alsace-Lorraine Service carte géol. Bull. | Service de la Carte géologique de la Alsace et de la Lorraine, Bullétin. Strasbourg. |
| Am. Assoc. Petroleum Geologists Bull. | American Association of Petroleum Geologists, Bulletin. Tulsa, Okla. |
| Am. Ceramic Soc. Ceram. Abs. and Bull.; Jour. | American Ceramic Society, Ceramic Abstracts and Bulletin; Journal. Easton, Pa. |
| Am. Chem. Soc. Jour. | American Chemical Society, Journal. Easton, Pa. |
| Am. Geologist | American Geologist. Minneapolis, Minn. |
| Am. Inst. Min. Metall. Eng. [Am. Inst. Min. Eng.] Tech. Paper; Tech. Pub.; Trans.; Yearbook. | American Institute of Mining and Metallurgical Engineers [American Institute of Mining Engineers, 1871–1918], Technical Papers; Technical Publications; Transactions; Yearbook. New York. |
| Am. Jour. Sci. | American Journal of Science. New Haven, Conn. |
| Am. Mineralogist | American Mineralogist. Lancaster, Pa. |
| Am. Soil Survey Assoc. Rept.; Bull. | American Soil Survey Association [1921–1936; 1936–date, see Soil Science Society of America], Report; Bulletin. |
| Analele min. România | Analele minelor din România (Annales des mines de Roumanie). Bucarest. |
| Annales chimie et physique | Annales de chimie et de physique. Paris. |
| Annales mines Mém. | Annales des mines, Mémoires. Paris. |
| Antiquarian Nat. History Soc. Ark. | Antiquarian and Natural History Society of the State of Arkansas. Little Rock. |
| Ark. Bur. Mines Bienn. Rept. | Arkansas Bureau of Mines, Biennial Report. Little Rock. |
| Ark. Bur. Mines, Manufactures, and Agriculture. | Arkansas Bureau of Mines, Manufactures, and Agriculture. Little Rock. |
| Ark. Democrat | The Arkansas Democrat. Little Rock. |
| Ark. Gaz. | The Arkansas Gazette. Little Rock. |
| Ark. Geol. Survey Ann. Rept.; Bull.; Inf. Circ. | Arkansas Geological Survey, Annual Report; Bulletin; Information Circular. Little Rock. |
| Ark. Mineralog. Soc. Bull. | Arkansas Mineralogical Society, Bulletin. Little Rock. |
| Ark. Press | The Arkansas Press. Little Rock. |
| Australasian Inst. Min. Metallurgy Proc. | Australasian Institute of Mining and Metallurgy, Proceedings. Melbourne. |
| Australia, Bur. Min. Res., Geology, and Geophysics Bull.; Summary Rept. | Australia, Bureau of Mineral Resources, Geology, and Geophysics, Bulletin; Summary Report. Canberra. |
| Australia, Council Sci. Indus. Res. Bull. | Australia, Council for Science and Industrial Resources, Bulletin. Melbourne. |

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| Australia Min. Res. Survey Bull., Geol. Ser.; Summary Rept. | Australia Mineral Resources Survey Bulletin, Geological series; Summary Report. Canberra. |
| Austria, Geol. Bundesanst. [K. k. geol. Reichsanst; Geol. Staatsanst.] Verh. | [Austria] Geologische Bundesanstalt [1925–date; to 1920, Kaiserlich-königlich geologische Reichsanstalt; 1920–21, Geologische Staatsanstalt] Verhandlungen. Vienna. |
| Bányászati és kohászati lapok | Bányászati és kohászati lapok. Budapest. |
| Berg- u. hüttenm. Jahrb | Berg- und hüttenmännisches Jahrbuch. Vienna. |
| Berg- u. hüttenm. Zeitung | Berg- und hüttenmännische Zeitung. Freiberg; Leipzig. |
| Brazil, Conselho Fed. Comercio Ext. Bol. | [Brazil] Conselho Federal de Comercio Exterior, Boletin. Rio de Janeiro. |
| Brazil, Serviço (Div.) Fomento Producão Min. Avulso; Bol. | [Brazil] Serviço (or Divisão) de Fomento da Producão Mineral, Avulso; Boletim. Rio de Janeiro. |
| Brignoles sta. bot., Lab. minéralogie | Brignoles station botanique, Laboratoire de minéralogie. |
| British Ceramic Soc. Trans | British Ceramic Society, Transactions. North Staffordshire. |
| British Guiana Geol. Survey Bull | British Guiana Geological Survey, Bulletin. Georgetown, Demerara. |
| Calif. State Min. Bur. Bull | California State Mining Bureau, Bulletin. San Francisco. |
| Canada Munitions Res. Comm. Final Rept. | Canada Munitions Resources Commission, Final Report. Toronto. |
| Canadian Inst. Min. Metallurgy Trans | Canadian Institute of Mining and Metallurgy, Transactions. Ottawa. |
| Canadian Min. Metall. Bull | Canadian Mining and Metallurgical Bulletin. Ottawa. |
| Canadian Min. Jour | Canadian Mining Journal. Toronto. |
| Cement, Mill, and Quarry | Cement, Mill, and Quarry. Chicago. |
| Centralblatt . . ., *See* Zentralblatt. | |
| Česká akad. věd. umění Rozpravy, Třída II, Math.-přírod. | Česká akademie vědomí a umění, Rozpravy, Třída II, Mathematico-přírodnická. Prague. |
| Chambre syndicale Française mines metall. | Chambre syndicale Française des mines metalliques. Paris. |
| Chem. Age | Chemical Age. London. |
| Chem. and Eng. News | Chemical and Engineering News. Easton, Pa. |
| Chem. Industries | Chemical Industries. New York. |
| Chem. News and Jour. Indus. Sci | Chemical News and Journal of Industrial Science. London. |
| Chem. Soc. London Jour | Chemical Society of London, Journal. |
| Chem. Trade Jour. and Chem. Engineer. | Chemical Trade Journal and Chemical Engineer. London. |
| Chem. Weekbl | Chemisch Weekblad. Amsterdam. |
| Chemie der Erde | Chemie der Erde (Linck und Blanck). Jena. |
| Chemiker-Zeitung | Chemiker-Zeitung. Cöthen. |

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| Chimie et industrie; sources et débouches. | Chimie et industrie; sources et débouches. Paris. |
| China (Natl.) Geol. Survey Bull | China, (National) Geological Survey, Bulletin. Peking. |
| China Mineral Expl. Bur. Contrib. Econ. Geology. | China, Mineral Exploration Bureau, Contributions to Economic Geology. Kueiyang. |
| Chronique mines coloniales | Chronique des mines coloniales (Bureau d'études géologiques et minières coloniales). Paris. |
| Colliery Guardian | Colliery Guardian. London. |
| Colonial Geology and Min. Res | Colonial Geology and Mineral Resources. London. |
| Colo. School Mines Quart | Colorado School of Mines Quarterly. Golden. |
| Compass | Compass. Menasha, Wis. |
| Cong. internat. géographie, 13e, Paris, 1931, Comptes rendus. | Congrès international de géographie, 13e, Paris, 1931, Comptes rendus. |
| Cong. internat. mines, metallurgie, geologie appl., Sec. geologie appl. | Congrès international des mines, de la métallurgie et de la géologie appliquée, Section de géologie appliquée. Paris. |
| Cong. Panam. Engenharia Minas e Geología, 2° cong., Rio de Janeiro, 1946, Anais. | Congresso Panamericano de Engenharia de Minas e Geología, Anais do Segundo Congresso, 1946. Rio de Janeiro. |
| Conn. Acad. Arts Sci. Trans | Connecticut Academy of Arts and Sciences, Transactions. New Haven, Conn. |
| Czechoslovakia, Státní geol. ústav Věstník; Sborník. | Czechoslovakia, Státní geologický ústav, Věstník, Sborník. Prague. |
| Daily Chronicle | Daily Chronicle, Limited. [Georgetown?] British Guiana. |
| Deutsche chem. Gesell. Ber | Deutsche chemische Gesellschaft, Berichte. Berlin. |
| Deutsche geol. Gesell. Zeitschr.; Abt. B Monatsh.; Monatsber.; Verh. | Deutsche geologische Gesellschaft, Zeitschrift; Abt. B, Monatsheft; Monatsbericht; Verhandlungen. Berlin. |
| Dinglers polytech. Jour | Dinglers polytechnisches Journal. Berlin. |
| Državi géol. zavod Vijeski | Državi géološki zavod, Vijesti (Institut géologique de Zagreb, Bulletin). Zagreb. |
| Econ. Geography | Economic Geography. Worcester, Mass. |
| Econ. Geology | Economic Geology. Lancaster, Pa. |
| Edinburgh Geol. Soc. Trans | Edinburgh Geological Society, Transactions. |
| Edinburgh New Philos. Jour | Edinburgh New Philosophical Journal. |
| Elektrochem. Zeitschr | Elektrochemische Zeitschrift. Berlin. |
| Eng. Min. Jour | Engineering and Mining Journal [1869–1922 and 1926–date; 1922–1926, Engineering and Mining Journal-Press]. New York. |

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| Escola Mina Rev | Escola de Mina, Revista. Ouro Preto, Brazil. |
| Federated Inst. Min. Engineers Trans | Federated Institution of Mining Engineers, Transactions. Newcastle-upon-Tyne. |
| Földt. szemle | Földtani szemle; Géologiai és paleontológiai folyóirat (Ungarische Rundschau für Geologie und Palaeontologie). Budapest. |
| Fortschr. Geologie u. Palaeontologie | Fortschritte der Geologie und Palaeontologie. Berlin. |
| France, Carte géol. Mem | France, Carte géologique, Mémoirs. Paris. |
| French West Africa, Service géol. Rap. ann. | Gouvernment Général de l'Afrique Occidentale Française, Service géologiques, Rapport annuel. Dakar. |
| French West Africa, Service mines Bull | Gouvernment Général de l'Afrique Occidentale Française, Service des mines, Bulletin. Dakar. |
| Fühlings landw. Zeitung | Fühlings landwirtschaftliche Zeitung. Stuttgart. |
| Ga. Geol. Survey Bull | Georgia Geological Survey, Bulletin. Atlanta. |
| Gazz. chim. Italiana | Gazzeta chimica Italiana (Società Chimica Italiana). Rome. |
| Génie civil | Le Génie civil. Paris. |
| Geog. Rev | Geographical Review (American Geographical Society of New York). |
| Geol. Assoc. Canada Proc | Geological Association of Canada, Proceedings. Toronto. |
| Geol. Gesell. Wien Mitt | Geologische Gesellschaft in Wien, Mitteilungen. |
| Geol. Mag | Geological Magazine. London. |
| Geol. Soc. America Bull | Geological Society of America, Bulletin. New York. |
| Geol. Soc. China Bull | Geological Society of China, Bulletin. Peiping. |
| Geol. Soc. Tokyo Jour | Geological Society of Tokyo, Journal. |
| Geol. Zentralbl | Geologisches Zentralblatt. Leipzig; Berlin. |
| Geologie en Mijnbouw | Geologie en Mijnbouw. The Hague. |
| Geophysics | Geophysics. Houston, Tex.; Tulsa, Okla. |
| Germany, Reichsamt f. Bodenforschung Jahrb., Abh. [Reichst. f. Bodenforschung; Preuss. geol. Landesanst.] | Jahrbuch des Reichsamts für Bodenforschung, Berlin. [1941–date; 1940–1941, Reichstelle für Bodenforschung; 1881–1942, Preussische Geologische Landesanstalt ] |
| Giorn. geologia | Giornale di geologia [1926–date; 1903–1925 Giornale de geologia praktica]. Bologna. |
| Gold Coast Geol. Survey Dept. Rept | Gold Coast Report of the Geological Survey Department. Accra. |

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| Gold Coast Geol. Survey Bull | Gold Coast Geological Survey, Bulletin. Accra. |
| Great Britain Geol. Survey and Mus. Pract. Geology Summary Progress. | Great Britain, Geological Survey and Museum of Practical Geology, Summary of Progress. |
| Glückauf | Glückauf, berg- und hüttenmännische Zeitschrift. |
| Gwalior Mineralog. Series | Gwalior Mineralogical Series. India. |
| Heidelberg. Beitr. Mineralogie u. Petrographie. | Heidelberger Beiträge zur Mineralogie und Petrographie. |
| Hungary, (K.) Ungarische geol. Anst. Jahresber.; Mitt. | (Königlich) Ungarische geologische Anstalt, Jahresberichte; Mitteilungen. Budapest. |
| Idaho Bur. Mines and Geology Inf. Leaflet. | Idaho Bureau of Mines and Geology, Information Leaflet. Moscow, Idaho. |
| Ill. State Geol. Survey Rept. Inv | Illinois State Geological Survey, Report of Investigations. Urbana. |
| Imp. Bur. Soil Sci., Rothamsted Exper. Sta. Tech. Comm. | Imperial Bureau of Soil Science, Rothamsted Experimental Station, Technical Communication. Harpenden, England. |
| Imp. Inst. Bull.; Mon. Min. Res | Imperial Institute, Bulletin; Monographs on Mineral Resources. London. |
| Imp. Min. Res. Bur. Mineral Industry | Imperial Mineral Resource Bureau, Mineral Industry of the British Empire and Foreign Countries. London. |
| India, Geol. Survey Mem.; Rec | India, Geological Survey, Memoirs; Records. Calcutta. |
| Indian Ceramic Soc. Trans | Indian Ceramic Society, Transactions (Benares Hindu University). [Poona?]. |
| Indian Minerals | Indian Minerals (India Geological Survey), Calcutta. |
| Indian Sci. Cong | Indian Science Congress. Calcutta. |
| Industria mineraria | Industria mineraria. Rome. |
| Indus. and Eng. Chemistry | Industrial and Engineering Chemistry (American Chemical Society), Easton, Pa. [name varies]. |
| Indus. Australian and Min. Standard | Industrial Australian and Mining Standard. Melbourne; Sydney. |
| Ingenieur Indonesië [Nederlandsch-Indië]—IV Mijnbouw en geologie. | Ingenieur in Indonesië [1943–date; 1934–1942, Nederlandsch-Indië], IV Mijnbouw en Geologie. Bandoeng. *See also* Mijningenieur. |
| Inst. Geog. Geol. I. G. G.; Rev | Instituto Geográphico e Geologico, I. G. G.; Revista. São Paulo, Brazil. |
| Inst. geol. España Bol | Instituto geologico de España, Boletín. Madrid. |
| Inst. geol. Romániei, Studii tech. econ., Ser. A. | Institutul geologic al Romániei, Studii Technice si Economice, Ser. A. |
| Inst. geol. Zagreb. Bull | Institut géologique de Zagreb, Bulletin. |
| (R.) Inst. lombardo sci. Rendiconti | (Real) Instituto lombardo di scienze e lettere, Rendiconti. Milan. |

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| Inst. Min. and Metallurgy Bull.; Trans. | Institution of Mining and Metallurgy, Bulletin; Transactions. London. |
| Inst. Min. Eng. Trans. | Institution of Mining Engineers, Transactions. Newcastle-upon-Tyne. |
| Inst. Pesquisas Technol. São Paulo, Bol. | Instituto de Pesquisas Technologicas de São Paulo, Boletim. |
| Inst. prikladnoy mineralogii i metalurgii Trudy. Moscow. | Institut prikladnoy mineralogii i metalurgii, Trudy (Institute of Economic Mineralogy and Metallurgy, Transactions). Moscow. |
| Internat. Cong. Soil Sci., 2d, Leningrad - Moscow, 1930, Proc. and Papers, Comm. V. | International Congress of Soil Science, Proceedings and Papers of the 2d Congress, Commission V, July 1930. Leningrad-Moscow. |
| Internat. Geog. Cong., 6th, London, 1895, Rept. | International Geographical Congress, Report of the 6th Congress. London. |
| Internat. Geol. Cong., 16th Sess., United States, 1933, Guidebook. | International Geological Congress, 16th Session, United States, 1933, Guidebook. |
| Ireland, Geol. Survey Mem.; Min. Res. | Ireland, Geological Survey, Memoirs; Mineral Resources. Dublin. |
| Irish Naturalist | Irish Naturalist. Dublin. |
| Iron and Steel Inst. Jour. | Iron and Steel Institute Journal. London. |
| Istria agricola | Istria agricola. Parenzo. |
| Italy, (R.) Ufficio geol. Italia Boll. | (Reale) Ufficio geologico d'Italia, Bollettino. Rome. |
| Jahresber. Chemie | Jahresbericht der Chemie. |
| Jammu and Kashmir Govts. Min. Survey Rept. | Jammu and Kashmir Governments, Minerals Survey Report. |
| Japanese Assoc. Mineralogists, Petrologists, and Econ. Geologists Jour. | Japanese Association of Mineralogists, Petrologists, and Economic Geologists, Journal. Sendai. |
| Japanese (Imp.) Geol. Survey | Japanese (Imperial) Geological Survey. Tokyo. |
| Japanese Jour. Geology and Geography. | Japanese Journal of Geology and Geography (National Research Council of Japan), Tokyo. |
| Jour. Agr. Sci. | Journal of Agricultural Science. London. |
| Jour. Chem. Physics | Journal of Chemical Physics (American Institute of Physics). Lancaster, Pa. |
| Jour. Geography | Journal of Geography. Tokyo. |
| Jour. Geology | Journal of Geology. Chicago. |
| Jour. Sci. Indust. Research | Journal of Scientific and Industrial Research. Delhi. |
| Jugoslavenska akad. znanosti i umjetnosti Radi. | Jugoslavenska akademija znanosti i umjetnosti, Radi. Zagreb. |
| Kazan'. gosudar. univ., Obshch. yestestvoispyitateley Trudy. | Kazan'skogo gosudarstvennyi universitet, Obshchestvo yestestvoispitateley [Kazan State University, Society of Naturalists], Trudy. |
| Kazan'. univ. Uchenyye zapiski geologiya. | Uchenyye zapiski kazanskogo universiteta, Geologiya [Kazan University Science Memoirs, Geology]. |

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| Kolloid-Zeitschr | Kolloid-Zeitschrift. Dresden; Leipzig. |
| Landbouwk. tijdschr | Landbouwkundig tijdschrift. The Hague. |
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| Leningrad. geol.-gid.-geodez. tresta Izv. | Leningradskogo geologo-gidro-geodezicheskogo tresta, Izvestiya (Leningrad Geological, Hydrogeological, and Geodetic Trust, Bulletin). Leningrad. |
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| Magyar kir. földt. intézet Évi jelentései; Évkönyve (K. Ungarische geol. Anst. Jahresber.; Mitt.). | Magyar királyi földtani intézet, Évi jelentései; Évkönyve (Königlich Ungarische geologische Anstalt, Jahresberichte; Mitteilungen). Budapest. |
| Magyar kir. Jószef Nádor müszaki és gazdaságtudományi egyetem, A bánya- és kohómérnöki osztály Közleményei. | Magyar királyi Jószef Nádor müszaki és gazdaságtudományi egyetem, A bánya- és kohómérnöki osztály Közleményei [Royal Hungarian Palatine Josef University, Department of Mining and Metallurgy Publications] Sopron. |
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| Manchester Geol. Soc. Trans | Manchester Geological Society, Transactions. |
| Manufacturer's Rec | Manufacturer's Record. Baltimore. |
| Metal Bull | Metal Bulletin. London. |
| Metal Industry | Metal Industry. London. |
| Metall u. Erz | Metall und Erz. Halle. |
| Metall. Rev | Metallurgical Review. New York. |
| Metallwirt., Metallwiss., Metalltech | Metallwirtschaft, Metallwissenschaft, Metalltechnik. Berlin. |
| Metals and Alloys | Metals and Alloys. Easton, Pa.; New York. |
| México, Univ. Nac., Inst. Géología [Géol., through 1924] Anales; Bol. | México, Universidad Nacional, Instituto Géología [1930–date; Instituto Geológico, through 1924] de México, Anales; Boletín. México, D. F. |
| Mijningenieur | De Mijningenieur; Maandblad voor Mijnbouw en Geologie in Nederland en Koloniën [1920–33]. Bandoeng. |

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| Min. Jour | Mining Journal. London. |
| Min. Jour | Mining Journal. Phoenix, Ariz. |
| Min. Mag | Mining Magazine. London. |
| Min. Reporter | Mining Reporter. Denver. |
| Min. Sci | Mining Science. Denver. |
| Min. Sci. Press | Mining and Scientific Press. San Francisco. |
| Min. Technology | Mining Technology (American Institute of Mining and Metallurgical Engineers, Technical Publications). New York. |
| Min. World | Mining World. Seattle. |
| Mine and Quarry Eng | Mine and Quarry Engineering. London. |
| Mineração e Metallurgia | Mineração e Metallurgia. Rio de Janeiro. |
| Mineral Industry | Mineral Industry, its statistics, technology and trade during [1892–1941]. New York. [Title varies slightly.] |
| Mineralog. Mag. and Jour. Mineralog. Soc. | Mineralogical Magazine and Journal of the Mineralogical Society. London. |
| Mineralog. petrograph. Mitt | Mineralogische und petrographische Mitteilungen. Vienna. |
| Mines and Minerals | Mines and Minerals. Scranton, Pa. |
| Mines, carrières | Mines, carrières, et grandes entreprises. Paris. |
| Mines Mag | Mines Magazine (Colorado School of Mines). Golden, Colo. |
| Min. Geol. Jour | Mining and Geological Journal (Victoria Department of Mines). Victoria, Australia. |
| Miniera Italiana | Miniera Italiana. Rome. |
| Mining and Metallurgy | Mining and Metallurgy (American Institute of Mining and Metallurgical Engineers). New York. |
| Miss. State Geol. Survey Bull | Mississippi State Geological Survey, Bulletin. Oxford. |
| Mo. Acad. Sci. Proc | Missouri Academy of Science, Proceedings. Columbia. |
| Mo. Geol. Survey and Water Res. Bienn. Rept.; Inf. Circ.; Volumes. | Missouri Geological Survey and Water Resources, Biennial Report; Information Circular; Volumes. Rolla. |
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| Montan. Rundschau | Montanistische Rundschau. Berlin. |
| Moskov. obshch. ispytateley Prirody; Otdel geol. Byull. | Moskovskogo obshchestva ispytateley, Prirody; Otdel geologicheskii Byulletem (Société des naturalistes de Moscou, Bulletin, Section géologique). |
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| Nat. Acad Peiping, Sec. Geology | National Academy of Peiping, Section of Geology. |
| Nat. History | Natural History (American Museum of Natural History). New York. |
| Naturw | Die Naturwissenschaften. Berlin. |
| Natuurk. Tijdschr. Nederlandsch Indië | Natuurkundig Tijdschrift voor Nederlandsch Indië (Madjalah Ilmu Alam Untuk Indonesia). Buitenzorg, Bandung. |
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| Nederlandsch-Indië, Dienst Mijnbouw Versl. en Meded. | Nederlandsch-Indië, Dienst van den Mijnbouw, Verslagen en Mededeelingen betreffende Indische delfstoffen en hare toepassingen. Batavia. |
| Neues Jahrbuch.; Beil.-Band; Festband; Monatsh.; Referate. | Neues Jahrbuch für Mineralogie, Geologie und Paläontologie; Beilage-Band; Festband zur Feier des 100 Jahrigen Bestehens; Monatshefte; Referate. Heidelberg; Stuttgart. |
| New South Wales Geol. Survey Ann. Rept.; Bull.; Mem. | New South Wales Department of Mines, Geological Survey, Annual Report; Bulletin; Memoirs. Sydney. |
| Niederrheinische Gesell. Natur- u. Heilkunde Sitzungsber. | Niederrheinische Gesellschaft für Natur- u. Heilkunde, Sitzungsberichte. Bonn. |
| Nippon Kogyo Kwaishi | Nippon Kogyo Kwaishi (Mining Institute of Japan). Tokyo. |
| Norsk geol. tidsskr | Norsk geologisk tidsskrift. Kristiania; Oslo. |
| North England Inst. Min. Engineers Trans. | North of England Institute of Mining Engineers, Transactions. Newcastle-upon-Tyne. |
| Nyasaland, Geol. Survey Dept. Ann. Rept.; Bull. | Nyasaland Protectorate, Geological Survey Department Annual Report; Bulletin. Livingstonia. |
| Oberhess. Gesell. Natur- u. Heilkunde Ber. | Oberhessische Gesellschaft für Natur- und Heilkunde, Bericht. Giessen. |
| Ontario Bur. Mines Rept | Ontario Bureau of Mines, Report. Toronto. |
| Oreg. Dept. Geology and Mineral Industries Bull.; G. M. I. Short Paper. | Oregon Department of Geology and Mineral Industries, Bulletin; G. M. I. Short Paper. Portland. |
| Pacific Sci | Pacific Science. Hawaii. |
| Pacific Sci. Cong., 6th, Proc | Pacific Science Congress, Proceedings of the 6th Congress. Berkeley and San Francisco, Calif. |
| Pan-Am. Geologist | Pan-American Geologist. Des Moines. |
| Petermanns Mitt | Petermanns Mitteilungen. Gotha. |

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| Pit and Quarry | Pit and Quarry. Chicago. |
| Preuss. Geol. Landesanst | Preussische Geologische Landesanstalt. Berlin. *See* Germany, Reichsamt . . . |
| Problemy Sovetskoy geologii | Problemy Sovetskoy geologii (Problems of Soviet Geology), Organ Soyuzgeorazvedkii NITO, TsNIG'RI, Moscow ONTI. |
| Przemys Chemiczny | Przemys Chemiczny. Warsaw. |
| Quarry | Quarry and Surveyors' and Contractors' Journal. London. |
| Queensland Govt. Min. Jour | Queensland Government Mining Journal. Brisbane. |
| Rassegna min. metall. chim | Rassegna mineraria, metallurgica e chimica. Rome. |
| Razvedka nedr | Razvedka nedr (Exploration Underground). Moscow. |
| Rev. géographie phys. géologie dynam | Revue de géographie physique et de géologie dynamique. Paris. |
| Rev. Minera, Geología, Mineralogía | Revista Minera, Geología y Mineralogía. Buenos Aires. |
| Rev. minera, metalúrgica, ingeniería | Revista minera, metalúrgica y de ingeniería. Madrid. |
| Rev. univ. mines | Revue universelle des mines, de la métallurgie, des travaux publics, des sciences et des arts appliquées à l'industrie. Liége. |
| Roy. Dublin Soc. Sci. Trans | Royal Dublin Society, Scientific Transactions. |
| Roy. Soc. New South Wales Jour. and Proc. | Royal Society of New South Wales, Journal and Proceedings. Sydney. |
| Roy. Soc. Western Australia Jour | Royal Society of Western Australia, Journal. Perth. |
| Rudarski i topionički Vesnik | Rudarski i topionički, Vesnik. Belgrad. |
| Schweizerische mineralog. petrog. Mitt | Schweizerische mineralogische und petrographische Mitteilungen. Frauenfeld |
| Science | Science. Lancaster, Pa. |
| Scotland Geol. Survey Mem | Scotland Geological Survey, Memoirs. Edinburgh. |
| (R.) Soc. Española historia nat. Bol | (Real) Sociedad Española de historia natural, Boletín. Madrid. |
| Soc. Française minéralogie Bull | Société Française de minéralogie, Bulletin. Paris. |
| Soc. fribourg. sci. nat., Geologie et geographie Mém. | Société fribourgeoise des sciences naturelles, Géologie et géographie, memoirs. Fribourg. |
| (R.) Soc. geog. Italiana Boll | (Real) Società geografica Italiana, Bollettino. Rome. |
| Soc. géol. Belgique Annales; Congo Belge annéc; Bull. | Société géologique de Belgique, Annales; Congo Belge Année; Bulletin. Liége. |
| Soc. géol. France Bull | Société géologique de France, Bulletin. Paris. |
| Soc. geol. Italiana Boll | Società geologica Italiana, Bollettino. Rome. |

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| Soc. géol. minéralog. Bretagne Bull | Société géologique et minéralogique de Bretagne, Bulletin. |
| Soc. Helvétique sci. nat. Actes | Société Helvétique des science naturelles, Actes (Schweizerische naturforschende Gesellschaft, Verhandlungen). Geneva. |
| Soc. Italiana prog. sci. Atti | Società Italiana per il progresso delle scienze, Atti. |
| Soc. Nac. Minería Bol. Min | Sociedad Nacional de Minería, Boletín Minero. Santiago, Chile. |
| Soc. naturalisti Napoli Boll | Società dei naturalisti in Napoli, Bollettino. Naples. |
| Soc. toscana sci. nat. Pisa Atti; Memorie; Processi verbali. | Società toscana di scienze naturali di Pisa, Atti; Memorie; Processi verbali. [Name varies.] |
| Soc. vaudoise sci. nat. Mém | Société vaudoise des sciences naturelles, Mémoires. Lausanne. |
| Soil Sci | Soil Science, Rutgers University, New Brunswick, N. J. |
| Soil Sci. Jour | Soil Science Journal. Oxford. |
| Soil Sci. Soc. America Proc | Soil Science Society of America, Proceedings. Ann Arbor, Mich. |
| South African Min. Eng. Jour | South African Mining and Engineering Journal. Johannesburg. |
| Stein-Industrie u. Stein-Strassenbau | Stein-Industrie und Stein-Strassenbau. Berlin. |
| Suriname Geol.-Mijnbouwk. Dienst Jaarv. | Geologisch - Mijnbouwkundige Dienst van Suriname, Jaarverslag. |
| Tanganyika Dept. Lands and Mines, Geol. Div. Bull. | Tanganyika Territory, Department of Lands and Mines, Geological Division, Bulletin. Dar es Salaam. |
| Teachers' Jour | Teachers' Journal. Accra, Gold Coast. |
| Technika | Technika; a Magyar mérnökök lapja. Budapest. |
| Tenn. Dept. Conserv., Div. Geology Bull.; Markets Circ. | Tennessee Department of Conservation, Division of Geology, Bulletin; Markets Circular. Nashville. |
| Tenn. Geol. Survey Bull.; Res. Tenn | Tennessee Geological Survey, Bulletin; Resources of Tennessee. Nashville. |
| Tex. Univ., Bur. Econ. Geology Min. Res. Circ. | Texas University, Bureau of Economic Geology, Mineral Resources Circulars. Austin. |
| Towarzystwa Nauk. Warszaw. Archiwum Mineralog. | Towarzystwa Naukowego Warszawskiego, Archiwum Mineralogiczne (Société des sciences de Varsovie, Archive de Minéralogie). Warsaw. |
| Tschermaks mineralog. petrog. Mitt | Tschermak und Beckes mineralogische und petrographische Mitteilungen. Vienna. |
| Uganda Geol. Survey Dept. Ann. Rept | Uganda Geological Survey Department, Annual Report. Entebbe. |

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| Ungarische geol. Gesell. Geol. Mitt.; Zeitschr. | Ungarische geologische Gesellschaft, Geologische Mitteilungen; Zeitschrift. Budapest. |
| U. S. Bur. Foreign and Domestic Trade Commerce Rept. | U. S. Bureau of Foreign and Domestic Trade, Commerce Report. |
| U. S. Bur. Mines Bull.; Min. Trade Notes; Minerals Yearbook; Rept. Inv.; Tech. Paper. | U. S. Bureau of Mines, Bulletin; Mineral Trade Notes; Minerals Yearbook; Report of Investigations; Technical Paper. |
| U. S. Dept. Commerce World Trade | U. S. Department of Commerce, World Trade in Commodities, Metals, and Minerals. |
| U. S. Far East Command GHQ Tokyo, Office of Engineer Rept. | U. S. Far East Command, General Headquarters, Tokyo, Office of the Engineer, Report. |
| U. S. Geol. Survey Ann. Rept; Bull; Geol. Atlas U. S.; Min. Res. U. S.; Strategic Minerals Inv. Prelim. Maps; World Atlas Commercial Geology. | U. S. Geological Survey, Annual Report; Bulletin; Geologic Atlas of the U. S.; Mineral Resources of the U. S.; Strategic Minerals Investigations, Preliminary Maps; World Atlas of Commercial Geology. |
| U. S. Natl. Res. Comm. WPA | U. S. National Resources Committee, Works Progress Administration. |
| U. S. S. R., Geol. kom., Glav. geol.-razved. uprav. Izv. | U. S. S. R., Geologicheskii komitet, Glavnogo geologo-razvedochnogo upravleniya, Izvestiya (Geological and Prospecting Service of U. S. S. R., Bulletin). Moscow-Leningrad. |
| U. S. S. R., Geol. kom. Izv | U. S. S. R., Geologicheskogo komiteta, Izvestiya (Bulletin du comité geologique). Leningrad. |
| U. S. S. R., Geol. kom. Obzor mineral'-nykh res. SSSR. | [U. S. S. R.] Geologicheskii komitet Obzor mineral'-nykh resursov SSSR (Geological Committee, Review of the Mineral Resources of the U.S.S.R.). Leningrad. |
| U. S. S. R., Tsentral'niye nauch.-issledov. geol.-razved. inst. Trudy; Mineral'nosyr'yevaya baza SSSR; Materyaly. | Tsentral'niye nauchno-issledovatel'skiy geologo-razvedochnyy institut (TsNIGRI), Trudy; Mineral'no-syr'yevaya baza SSSR; Materyaly (USSR Central Geological and Prospecting Institute, Transactions; Mineral Resources of the U.S.S.R.; Materials). Moscow-Leningrad. |
| Va. Acad. Sci. Proc | Virginia Academy of Science Proceedings. Charlottesville. |
| Va. Geol. Survey Repr. ser | Virginia Geological Survey, Reprint series. Charlottesville. |
| Věda-přírodní | Věda-přírodní měsičník pro šířeni a pěstování vědomí přirodních. Prague. |
| Victoria Geol. Survey Rec | Victoria Geological Survey, Records. Melbourne. |

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| Vses. geog. obshch. Izv | Vsesoyuznogo geograficheskogo obshchestva, Izvestiya (U.S.S.R. Geographical Society, Bulletin). Moscow-Leningrad. |
| Vses. geol. razved. ob"yedineniya Trudy | Vsesoyuznogo geologo-razvedochogo ob"yedineniya Trudy (United Geological and Prospecting Service of U.S.S.R., Transactions.) Moscow-Leningrad. |
| Vses. nauch.-issledov. inst. mineral'nogo syr'ya Trudy. | Vsesoyuznyy nauchno-issledovatel'skiy institut mineral'nogo syr'ya, Trudy (All-Union Scientific Research Institute of Economic Mineralogy, Transactions). Moscow-Leningrad. |
| Wash. Acad. Sci. Jour | Washington Academy of Sciences, Journal. Washington, D. C. |
| West African Rev | West African Review. London. |
| West-Indische Gids | West-Indische Gids [West Indian Guide]. Amsterdam; The Hague. |
| Western Australia, Geol. Survey Ann. Rept; Mem. | Western Australia, Geological Survey, Annual Report; Memoir. Perth. |
| Western Australia, Govt. Mineralog. Chem. Labs. | Western Australia, Government Mineralogical and Chemical Laboratories. Perth. |
| Western Siberia, Zapadno-sibir. geol. tresta Vestnik | Zapadno-sibirskogo geologicheskogo tresta, Vestnik (West Siberian Geological Trust, Messenger). Tomsk. |
| Western Siberia, Zapadno-sibir. geol.-razved. tresta Vestnik. | Zapadno-sibirskogo geologo-razvedochnogo tresta, Vestnik (West Siberian Geological-Prospecting Service, Bulletin). Tomsk. |
| Zeitschr. angew. Chemie | Zeitschrift für angewandte Chemie. Berlin; Leipzig. |
| Zeitschr. anorg. allg. Chemie | Zeitschrift für anorganische und allgemeine Chemie [1916-date; 1892–1915 Zeitschrift für anorganische Chemie]. Hamburg; Leipzig. |
| Zeitschr. Kristallographie | Zeitschrift für Kristallographie, Kristallgeometrie, Kristallphysik, Kristallchemie [1921–date; 1887–1920, Zeitschrift für Krystallographie und Mineralogie]. Leipzig. |
| Zeitschr. prakt. Geologie | Zeitschrift für praktische Geologie. Halle (Saale). |
| Zentralbl. Mineralogie, Geologie, Paläontologie; Abt. A; Abt. B. | Zentralblatt für Mineralogie, Geologie und Paläontologie; Abteilung A, Mineralogie und Petrographie; Abteilung B, Geologie und Paläontologie. [1900–1934, Centralblatt . . . ; 1934–1942, 1950 to date, Zentralblatt . . .]. Stuttgart. |

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**Achenbach, Herman.**

Thermischer Abbau von synthetischem Hydrargillit und die dabei entstehenden Phasen: Chem. der Erde, Band 6, Heft 3, p. 307–356, 9 figs., 1931 [German].

Tests were made with synthetic aluminum trihydrate (hydrargillite or gibbsite) and samples of boehmite and kaolinite to determine the effects of changes in time, pressure, and temperature in heating hydrous material. Some of these were: a difference in the pressure affected the shape of the thermal dehydration curve; the time required for samples to come to equilibrium and the amount of water loss at specific temperatures varied with the pressure; and X-ray photographs of the minerals, taken before the samples were heated to a variety of temperatures and after their subsequent cooling, showed that changes had taken place.

**Adams, George I.**

1. Bauxite deposits of the southern states: Econ. Geology, v. 22, no. 6, p. 615–620, 1 fig., 1927.

Bauxite deposits known to occur in Alabama, Georgia, and Tennessee in the southern part of the Appalachian Province and in Alabama and Georgia in the Coastal Plain Province are considered to have been formed during the same erosion interval. The deposits in the Appalachian region are related to a definite physiographic stage corresponding to the time of formation of the Highland Rim peneplain, and thus indicate a formation contemporaneous with those of the Coastal Plain, which are associated with sediments of Eocene age. The Arkansas deposits were formed in place by the weathering of syenite; these deposits are interbedded with Tertiary sediments.

2. The formation of bauxite in sink holes: Econ. Geology, v. 18, no. 4, p. 410–412, 1928.

Bauxite deposits in crater-like depressions in Georgia and Alabama are considered to have originally been clay-filled sink holes, the clay of which was altered to bauxite by percolating waters. Theories involving the action of hot springs and geysers and the transfer of material from great depth are shown to be unnecessary.

**Adye, E. Howard.**

Memoir on the economic geology of Navanagar State, in Kathiawar Province, India: 262 p., 40 pls., 9 col. geol. maps, Bombay, Thacker and Co., Ltd., 1914.

Bauxite, laterite deposits, and other weathering products, are described on pages 198–208.

**Aichino, G.**

1. Bauxite in Italy: Eng. Min. Jour., v. 74, no. 1, p. 41, 1902.

Bauxite was discovered in Italy about 2 years previously in the central Apennines. The most important of the deposits is at Lecce ne Marsi on the slopes of Monte Turchio. The deposit is 250 acres in extent and 3–10 feet thick. It is interbedded with limestones of Urgonian(?) age. The bauxite is oolitic and pisolitic. None of the deposits had been worked by the date of publication.

2. La Bauxite: Rassegna mineraria, v. 15, N[i] 15–18, 46 p., 1902 [Italian]; abs., Zeitschr. Kristallographie, Band 40, p. 296, 1905 [German].

**Ajtaj, Z. E.**

A Magyar bauxitbanya részvénytarsasag aluminiumérc banyaszata: Bányászati és kohászati lapok, Budapest, 1941 [Hungarian].

**Alcock, E. D.** *See* Gillin, J. A.

**Alexander, H. F.**

On the origin of cabook, or the laterite of Ceylon: Edinburgh Geol. Soc. Trans., v. 2, p. 113–118, 1872.

Cabook, the native name in Ceylon for laterite, is considered to be of possibly volcanic origin and to have been deposited as a clay lava in much the same manner as mud volcanos.

**Alexander, L. T.**

(and Hendricks, Sterling B., and Faust, George T.). Occurrence of gibbsite in some soil-forming materials: Soil Sci. Soc. America Proc., v. 6, p. 52–57, 1 fig., 1941.

Investigation of soil types in the southeastern United States showed that in the Davidson type—developed on amphibolite, norite, epidote greenstone schist, and diabase—and in the Madison type—developed on biotite-muscovite schist—one of the primary weathering products is gibbsite. The study also showed that in the samples examined, resilication of gibbsite to form kaolinite occurs when silica is liberated by weathering of minerals close to the gibbsite and within a few centimeters of the surface of the rock. In the underlying rocks here investigated, the minerals which are the source of the gibbsite are labradorite and bytownite-anorthite in the norites, epidote in the greenstone schist, biotite in the mica schist, and aluminous hornblende in the amphiboles.

**Allen, E. T.**

Note on the hydroxides of aluminum: Chem. News, v. 82, p. 75–76, 1900.

This paper reports a number of laboratory experiments on the precipitation of aluminum hydroxides from solution, and on the composition of the precipitate. The composition of the precipitated gelatinous hydroxide is the same as that of gibbsite, the trihydrate. This precipitate, heated to 100° C, loses water and becomes the dihydrate. However, in moist air it will take on water and revert to the trihydrate. It is concluded that the alumina with two molecules of water is too unstable to be found in nature.

**Allen, L. A.**

Bauxite mining in Arkansas: Cement, Mill, and Quarry, v. 27, no. 2, p. 39–40, 1925.

The mining operations of the American Bauxite Co. include both open pit and underground mines. The stripping of open pit mines is done in five separate steps, described in detail, starting with large steam shovels and finishing with steel brooms. The ore, like that in underground mines, is blasted and loaded onto cars. The underground mines at this time furnished about 60 percent of the total output of this company.

**Allen, Niel R.**

(and Hendryx, H. E., and Bingham, Mason L.). Seventh biennial report of the Department of Geology and Mineral Industries: Oreg. Dept. Geology and Mineral Industries Bull. 42, 25 p., 3 figs., 1950.

*Bauxite, p. 6.*—Ferruginous bauxite deposits in Oregon were discovered in 1944. From that time until 1949, the Alcoa Mining Co. drilled and test-pitted properties in Washington and Columbia Counties. No figures have been released, but reserves in this area may amount to "many millions of tons".

**Allen, S. A.**

Bauxite investigations, Eufaula district, Barbour and Henry Counties, Ala.: U. S. Bur. Mines Rept. Inv. 4521, 85 p., 112 figs., 1949.

The Eufaula bauxite district lies on the southeastern edge of Alabama, across the boundary between Barbour and Henry Counties. Bauxite was discovered in the district in 1923 and has been mined since 1926, mostly for chemical use. The types of drills used were the standard rotary type, hand auger, and power auger. These drills and drilling methods are described. Logs of all holes are included; location of the holes are shown on large-scale maps of areas drilled.

**Allen, Victor T.**

1. Effect of migration of clay minerals and hydrous aluminum oxides on the complexity of clay: Am. Ceramic Soc. Jour., v. 28, no. 10, p. 265–275, 11 figs. (incl. photomicrographs), 1945.

Migration of montmorillonite, nontronite, kaolinite, halloysite, dickite gibbsite, and diaspore at a number of localities is shown by the occurrence of these minerals as filling in cracks and crevices within clay. It is considered that the material generally migrates in colloidal suspension, favored by good drainage and the presence of dispersing agents.

2. Formation of bauxite from basaltic rocks in Oregon: Econ. Geology, v. 43, no. 8, p. 619–626, 1 fig., 4 pls. (photomicrographs), 1948.

Petrographic studies of Oregon bauxite and of a drill core showing more than 175 feet of weathering to the underlying parent basalts indicate that: (1) the plagioclase of the basaltic rocks weathered to kaolinite or halloysite; (2) ferrogmagnesian minerals and basaltic glass weathered to nontronite; (3) by loss of silica, the clay minerals changed to gibbsite and the high-iron bauxite. Relict structures occur throughout, except in the upper part where formation of pisolites has obscured them. The presence of clay, locally 100 feet thick, between the ferruginous bauxite and the basalt is taken as evidence that the bauxite here was formed by a two-stage process of weathering.

3. Some United States boehmite localities [abs.]: Geol. Soc. America Bull., v. 57, no. 12, pt. 2, p. 1173, 1946; Am. Mineralogist, v. 32, nos. 3–4, p. 195, 1947.

Boehmite was found to occur in Gasconade County, Mo.; in black pisolites in Pulaski County, Ark.; in flint clay in Carter County, Ky.; in Eocene shales and in deposits with diaspore in King County, Wash., and in clay in Riverside County, Calif.

4. Weathering of plagioclase feldspar to bauxite [abs.]: Geol. Soc. America Bull., v. 58, no. 12, pt. 2, p. 1161–1162, 1947.

A study of the drill core from a hole which penetrated 175 feet of bauxite and clay in Oregon showed that the content of alumina ranges from 47 to 25 percent in the upper 50 feet but ranges from only 35 to 24 percent in the lower 100 feet. It is considered that "plagioclase feldspars weathered to kaolinite-halloysite or to beidellite-nontronite; then gibbsite and bauxite formed from these minerals by the removal of silica."

**Anderson, Robert J.**

1. Aluminum and bauxite: Mineral Industry, 1922, v. 31, p. 8–37, 1923.

Statistics are given of domestic production of bauxite by States, imports, and consumption, 1914–22, and of world production by countries, 1916–22. Notes on mining areas and companies cover both the United States and foreign countries.

2. Aluminum and bauxite: Mineral Industry, 1923, v. 32, p. 7–40, 1924.

Statistics are given of domestic bauxite production by States, imports, and consumption, 1914–23, and of world production by countries, 1917–23. Brief notes on mining areas and companies in the United States and other countries are included.

3. Aluminum and bauxite: Mineral Industry, 1924, v. 33, p. 11–50, 1925.

Statistics are given of domestic production of bauxite by States, imports, and consumption, 1914–24, and of world production by countries, 1918–24. Brief notes on mining areas and companies in the U. S. and other countries are included.

4. Aluminum and bauxite: Mineral Industry, 1925, v. 34, p. 8–51, 1926.

Statistics are given of domestic production of bauxite by States, imports, and consumption, 1915–25, and of world production by countries, 1919–25. Brief notes on bauxite mining areas and operating companies in the United States and other countries are included.

5. The Russian bauxite-deposits: Min. Mag., v. 41, p. 9–15, 83–92, 1 fig. (geol. map), London, 1929.

The discussion is restricted to the bauxite deposits in the Cherepovetz government district of Tikhvin, Russia. Bauxite was first found in the area in 1916 by P. Timofeev. These deposits are the northernmost known and lie between the 59th and 60th parallels north. The location of 13 deposits, all of lower Carboniferous age, is shown on a small-scale geologic map. The average of 40 analyses of first class ore is 61.98 percent alumina, 7.07 percent silica, 13.77 percent iron oxide, 2.71 percent titania, and 14.02 percent water. The second part of the paper is a brief description of individual deposits, illustrated with maps and cross sections.

6. World resources of aluminum ore: Min. Mag., v. 55, no. 6, p. 329–341, 2 figs., London, 1936.

This paper is a comprehensive résumé of world resources and production of bauxite. The most important producing areas—Var, France; Arkansas, U. S. A.; Dutch Guiana; Gant, Hungary; Istria, Italy; British Guiana; Dalmatia, Yugoslavia; and Bintan Island, Indonesia—and the minor producing countries—U. S. S. R., India, and Germany—are discussed, showing relative size and output and related geographic factors. Reserves of the world, estimated by countries, total 964 million tons. Statistics are given of world production by countries for the years 1900–35, inclusive. The utilization of other materials—leucite, kaolinite, alunite, labradorite, and nepheline—as a source of aluminum is also discussed.

7. The aluminum industry of Japan: Min. Mag., v. 59, no. 2, p. 73–85, 1 fig., London, 1938.

Although the paper is largely a discussion of the control and production of aluminum, the sources and grade of bauxite and other ores used in the production of aluminum—high-alumina shales and alunite—are indicated.

8. Russian aluminum: Min. Mag., v. 58, p. 73–86, 1 fig., London, 1938.

Prior to 1928, the only source of bauxite known in the Soviet Union was near Tikhvin. The deposits were relatively small and low in grade. An extensive exploration program was carried on along the eastern slope of the Ural Mountains. Low-grade bauxite was discovered near Alapaevsk in 1929; in 1931 and subsequent years numerous deposits were found in the Rezh and the Nadezhdinsk (or

Kabakovsk) districts. The largest deposit in the latter is the Krasnaya Shapochka which has an average thickness of 13 feet and crops out for nearly 1¼ miles; reserves may amount to more than 10 million tons. Several deposits were discovered in 1933 and 1934 near Bogoslov, and still later on the Ivdel and Malai Taliza Rivers, and near Kamensk. Other deposits are now known on the western slope of the Urals. Reserves for the country as a whole are estimated at 45 million tons. Other sources of alumina are briefly mentioned. Most of the paper consists of a discussion of the processes used and the amounts of alumina and aluminum produced. A small-scale map shows the location of the aluminum mining and manufacturing districts.

9. The aluminum industry in Italy: Min. Mag. v. 61, no. 1, p. 13–27, 1 fig. (index map), London, 1939.

The bauxite resources of Italy are large enough that it is considered self-sufficient as far as its aluminum industry is concerned. In 1938 there were five aluminum reduction works in the country. The most important bauxite deposits are in the Istrian peninsula and in the south-central Apennines (Abruzzi and Campania districts). Other deposits occur in the Apulia district and near Gorizia (north of the Trieste region). The location of deposits, including alunite and leucite, and of processing plants is shown on a small-scale map. The major part of this paper is concerned with the aluminum industry—the important companies, capacities, imports and exports, and processes.

**Ansheles, I. M.**

1. Mikroskopicheskoye issledovaniye glin, peskov i boksitov Cherepovetskoy gubernii (A microscopic investigation of the clays, sands and bauxites of the Government of Cherepovetz): USSR Geol. kom. Izv., tom 46, no. 2, p. 113–140, Leningrad, 1927 [Russian, English summary].

The minerals present in the Devonian clays of the Borovichi and Tikhvin districts in the Cherepovetz region have been identified. Data at hand suggest the formation of bauxite from the underlying clay by oxidation of pyrite to sulfuric acid with the resulting decomposition of the clays. The aluminum sulfates could then be precipitated on contact with limestone or calcium carbonate waters. The bauxite occurs at a definite stratigraphic horizon in the Devonian system.

2. K. mineralogicheskomu sostavu salairskogo boksita (On the mineralogical composition of the Salair bauxites): USSR Geol. kom., Glav. geol.-razved. uprav. Izv., v. 50, p. 1169–1172, Moscow-Leningrad, 1931 [Russian, English summary].

Powdered bauxite from the Salair Range in U.S.S.R. was treated with HCl to remove carbonates. Optical studies showed that the residue contained the following: (1) brown ferric oxides, (2) an opaque mineral, and (3) hydrargillite. The index of refraction of the isotropic mineral ranges from 1.590–1.595 in the colored varieties to 1.580–1.78 in the colorless varieties. The highest index is considered to reflect the addition of titanic acid to the aluminum and silica gels.

**Antia, Dara P.**

Aluminum production in India: Indian Minerals, v. 1, no. 4, p. 238–244, 1947.

Resources of bauxite in India amount to 250 million tons of all grades of ore. Reserves of high-grade bauxite are estimated to be about 35,501,000. The latter tonnage is broken down into estimates of reserves for Bombay, Central Provinces, Madras, Bihar, Eastern States Agency, Bhopal, Kolhapur State, and Jammu and Kashmir. The largest tonnage, 15,100,000 tons, occurs in the Central Provinces.

Two companies were engaged in the production of aluminum in 1947. A large part of the paper is a discussion of cost, methods, and feasibility of the manufacture of aluminum in India.

**Arkhangel'skiy, A. D. (Arkhanguelsky).**

1. K voprosu ob usloviyakh obrazovaniya boksitov v SSSR (On the origin of bauxites of USSR): Moskov. Obshch. ispytateley Prirody, tom 41, Geol. ser. tom 11 (4), p. 405–436, Moscow, 1933 [Russian; English summary, p. 434–436].

The bauxite deposits of Russia occur at three stratigraphic horizons: in Devonian limestones in the northern Urals; overlying weathered Jurassic rocks along the whole eastern slope of the Urals; and in the Lower Carboniferous clayey rocks of the Moscow basin. The Devonian bauxites are considered to have been deposited in marine waters. The other two types of deposits are considered to be due to lateritic weathering followed by deposition in lakes or ponds.

2. (and Smolyaninov, N. A., editors). Trudy konferentsii po genezisu rud zheleza, margantsa i alyuminiya: Akad. nauk SSSR Trudy, Geol. ser., 1937, 648 p., 45 figs., 16 pls., Moscow, 1937 [Russian].

A symposium on the genesis of iron, manganese, and bauxite ores of the Soviet Union.

**Arni, Paul.**

Über die heute bekannten Bauxit-Vorkommen der Turkei: Maden tetkìk ve arama, sene 6, sayi 2/23, p. 115–143, 2 figs., 4 pls., Ankara, Turkey, 1941 [Turkish and German].

The geology of the bauxite deposits of Turkey is discussed. There are three main bauxite districts in the country; the Zonguldak on the Black Sea, the east and west Taurus Mountain districts, and the Nur Daglari (Amanos) district. According to analyses, high-grade bauxite from Zonguldak contains approximately 4 percent silica, 57 percent alumina, 24 percent iron oxide, 3 percent titania, and 13 percent loss on ignition. Analyses of bauxite from the western Taurus district are similar but are slightly higher in alumina and lower in iron oxide. The bauxite of Nur Daglari is too high in silica to be of commercial importance.

**Arsandaux, H.**

1. Contribution à l'étude des latérites: Acad. sci. Paris Comptes rendus, tome 149, p. 682–685; 1082–1084, 1909 [French].

Analyses of many samples of laterite show a high silica content. It is considered that these laterites are a mixture of the aluminum hydrates and of a micaceous aluminum silicate which is an intermediate weathering product.

2. Sur la composition de la bauxite: Acad. sci. Paris Comptes rendus, tome 148, p. 936–938, 1115–1118, 1909.

The results of 15 chemical analyses of French bauxites show that the alumina occurs as the monohydrate, and is considered to be the mineral diaspore although most of it is amorphous. The silica occurs as a silicate, $Si_2O_9Al_2H_4(H_2O)$.

3. Nouvelle contribution à l'étude des latérites: Acad. sci. Paris Comptes rendus, tome 150, p. 1698–1701, 1910 [French].

Laterization is considered to result in hydrated feldspars, the alumina of which will appear partly as a silicate and partly as a hydroxide. Muscovite, silica, and alkalies are the first products of the weathering of feldspar; and kaolinite, alumina, silica, and alkalies are the products of the subsequent weathering of the muscovite.

4. Contribution à l'étude de l'altération des roches silicatées alumineuses dans les régions intertropicales: Soc. Française minéralogie Bull., tome 36, p. 70–110, 1913 [French].

All the observed laterites occurred overlying the material from which they were derived. Two zones could be differentiated. In the first, contiguous to the original rock, the texture is the same, but the feldspar is replaced by a white aluminous material; coloring is ferric hydrate; and quartz remains intact. The second zone, overlying the first and grading into it, is clayey, uniformly yellow-red to red, and the average composition is similar to that of the underlying formation. The laterites observed by the author are the most common in tropical regions and are composed principally of aluminum silicates, with minor amounts of the hydrates of iron and aluminum. The alteration to laterites is essentially a phenomenon of hydration of aluminum silicates, particularly feldspars, in which they are changed to a material having a micaceous structure and composition. This material, in turn, changes into kaolinite.

**Ashley, George H.**

1. Outline introduction to the mineral resources of Tennessee: Tenn. Geol. Survey Bull. 2–A, p. 1–65, 1910.

Bauxite, p. 34–35: The bauxite discovered on the southeast slope of Missionary Ridge near Chattanooga is considered to be a northern extension of the Georgia-Alabama field, other deposits of which will probably be found in the vicinity. This deposit in 1907 was being mined by the National Bauxite Co.

2. Bauxite mining in Tennessee: Tenn. Geol. Survey Res. Tenn., v. 1, p. 211–219, 7 figs., 1911.

The Perry mine just east of Chattanooga and nearby prospects are briefly described. Hints for the further prospecting of the area are given.

3. Aluminum and bauxite mining in Tennessee: Min. World, v. 36, p. 557–558, 1 fig., 1912.

In 1912 only the Perry mine, operated by the National Bauxite Co., was in operation. This mine and the types of ore are described. A small sketch map shows the location of other described bauxite deposits in the vicinity.

4. Bauxite mining in Tennessee: Min. Sci., v. 65, p. 8–9, 1 fig., 1912.

The Perry mine, operated by the National Bauxite Co., is a pit 200–300 feet in diameter and about 100 feet deep. The ore is gray to creamy in color, or red, and is an earthy substance containing harder lumps consisting of small pellets. All the known deposits in Tennessee occur in the Knox dolomite. The ore pockets on the east side of Missionary Ridge lie in a straight line parallel to the crest of the ridge.

**Aubrey, A. J.**

The refractory uses of bauxite: Eng. Min. Jour., v. 81, p. 217–218, 1906.

For refractory use, bauxite is washed to remove free silica and calcined to 2,500° F (Seger cone 12). The calcined material, bonded with fire clay, sodium silicate, or lime, is made into brick or tile. These bricks, used in basic open-hearth steel furnaces, were found more resistant than magnesium bricks. Even with a high iron content these bricks are a superior furnace lining, and they are also used to line Portland cement kilns, and lead-refining furnaces.

**Aubury, L. E.**

The structural and industrial materials of California: Calif. State Min. Bur. Bull. 38, 412 p., 149 illus., 1906.

*Bauxite, p. 265.*—Bauxite is reported to occur in Yuba County, Calif., 2 miles southeast of Smartsville on the ranch of J. M. Dempsey. The bauxite was discovered in three places in a mine tunnel.

**Aufrère, L.**

La zonation des bauxites du midi de la France: Soc. géol. France Comptes rendus, 1934, fasc. 6 p. 80–82, 1934 [French].

The bauxite deposits of southern France, studied from the point of view of soil science, can be shown to retain in part the *A*, *B*, *C*, and *D* horizons. The *A* horizon is present at the top of a few deposits as a gray, humus layer above the eluvial horizon. The *B* horizon is white and argillaceous and easily distinguished from the underlying red ferruginous *C* horizon. The *D* horizon is represented by the parent rock.

**Augé, M.**

Note sur la bauxite, son origine, son âge et son importance géologique: Soc. géol. France Bull., 3e sér., tome 16, p. 345–350, 2 figs., 1888 [French].

The bauxite deposits in the vicinity of Villeveyrac and Madriat lie at the contact of limestones of the Urgonian and Cenomanian intervals of the upper Cretaceous. The theory of the precipitation of bauxite from hot waters, as from geysers, is discussed.

**Aytoun, A.**

Geology of the Southern Concan [India]: Edinburgh New Philos. Jour., 2d ser., v. 4, p. 67–84, 1 geol. map, 1856.

The red laterite of Southern Concan, India, is described in some detail in a geologic study of the area because it is so "intractable to vegetation" and so sterile that it can not support the agricultural population.

**Baker, James S.**

Brazil—land of great potential mineral wealth: Mining and Metallurgy, v. 26, no. 461, p. 249–251, 4 figs. [incl. spot loc. map], 1945.

This is a general paper on the mineral resources of Brazil. The location of mineral deposits of economic importance are shown by symbol on a small-scale map.

**Baldwin, E. M.** *See* Wilkinson, W. D.

**Ball, L. C.**

1. Bauxite at Tamborine North: Queensland Govt. Min. Jour., v. 41, no. 482, p. 184, 1 fig., 1940.

A short note describes the bauxite on the Tamborine Plateau. A section through the deposit shows, from top to bottom: 6 inches of red soil; 2½ feet of brownish subsoil; 4 feet of greenish pisolites, loosely cemented; and blue clay. Chemical analyses are included.

2. Re bauxite: Queensland Govt. Min. Jour., v. 41, no. 478, p. 84, 1940.

The discovery of bauxitic laterite resulting from the decomposition of andesitic basalts on the Tamborine Plateau is announced. The deposit occurs between Brisbane and the MacPherson Range, but the size is unknown. By the sulfuric acid method, 49.8 percent alumina and 16 percent iron oxide was dissolved out of the sample.

**Ball, V.**

Bauxite, *in* Geology of the Rajmehal Hills [India]: India Geol. Survey Mem., v. 13, pt. 2, p. 67–68, 1887.

Laterite overlies basalt as an incrustation at elevations from 600 feet above sea level to several hundred feet higher and occurs interbedded with white and purplish clays. "This association suggests that the laterite may, in these cases, be merely modified basalt, while the clay beds represent intertrappean layers." No chemical analyses are given, but it is stated that the material is high in iron and in places has been used as an ore of iron.

**Banerjea, S. B.**

Manganese and bauxite in India: Eng. Min. Jour., v. 122, p. 254, 1926.

Of India's vast deposits of bauxite, only one or two are worked; most of them are too remote from shipping ports, and rail freight charges are so high as to leave little or no profit in competition with deposits from other parts of the world.

**Baragwanath, W.**

Kaolin and bauxite: Min. Geol. Jour. (Victoria Dept. Mines), v. 2, no. 2, p. 115–117, 1940.

A brief description of the kaolin and bauxite in the State of Victoria, Australia, is presented. The kaolin deposits fall into three classes: alteration in place of large granitic masses; decomposed feldspathic dykes; and transported clays. Bauxite "appears to be due to chemical alteration of certain tuff and ash beds belonging to the older volcanic series" and related to an old land surface.

**Bartels, T. T.**

Bauxietwinning der Nederlandsch-Indische Bauxiet Exploitatie Maatschappij op Bintan: Ingenieur Indonesië, IV Mijnbouw en Geologie, 2e Jahrg., no. 1, p. IV 1–5, 3 figs., Jan. 1950 [Dutch].

Bauxite was discovered on Bintan Island, in Indonesia, in 1920, but mining did not begin until late 1935. A brief history of the development includes the names of interested companies and individuals. The Bintan bauxite is the so-called lateritic or gibbsitic type. The formation of the deposits is briefly sketched. Mining methods are also described.

**Barth, W.**

Einiges über die istrischen und dalmatin Bauxitlagerstätten, ihre Wirtschaftlichkeit und einige allgemeine, die deutsche Aluminiumindustrie betreffende Bemerkungen: Metall u. Erz, 22 Jahrg. N. F., 13, p. 99–103, 1925 [German].

The bauxite deposits of the karst region of Istria, Italy, and Dalmatia, Yugoslavia, and the general geology of the area are described from a regional point of view. The bauxite is considered to be largely an aluminum hydrate in colloidal form with admixtures of iron oxide and hydroxide, kaolin, and titanium oxide. The relationship between bauxite and terra rossa is discussed.

**Bataller Calatayud, José R.** *See also* Faura i Sans, M.

1. Las bauxitas de Cataluna: R. Acad. cienc. exactas Madrid Rev., v. 17 (2A ser., v. 2), p. 422–270, 7 figs., 6 pls. (incl. geol. map), 1919 [Spanish].

Literature on the formation and occurrence of bauxite is reviewed, and bauxite deposits of the world are described briefly. The bauxite deposits of Catalonia Province, Spain, and the stratigraphy of the area are discussed by districts. The

structure of the associated rocks and the topographic position of the bauxite deposits are shown in cross sections. The origin of the deposits is discussed. Chemical analyses of typical ore for each district, as well as a section on its commercial value, are included.

2. Las bauxitas del Pirineo de Lerida: Acad. cienc. Barcelona Mem., 3ra Época, num. 562, v. 27, no. 2, p. 41–93, 5 figs., 10 pls., 1943 [Spanish].

Bauxite was first discovered in Spain north of Castellvi de la Marca, Barcelona Province, in 1900. The deposits in the general region of Catalonia are numerous but small and low in grade. They occur in a region of complicated stratigraphy in which the age of the strata extends from Triassic to Eocene. The bauxite deposits are described in detail. The principal minerals are kaolinite, gibbsite, and boehmite. The Spanish bauxite appears to contain much boehmite. Bauxites are classified on the basis of the amounts of the aluminum and iron minerals present.

**Bauer, Max.**

1. Beiträge zur Geologie der Seychellen, insbesondere zur Kenntnis des Laterits: Neues Jahrbuch, Jahrg. 1898, Band 2, p. 162–219, 2 pls. (incl. geol. map, 1:400,000), Stuttgart, 1898 [German].

This paper strongly influenced later research on weathering processes. The laterite of the Seychelles is shown to be essentially the same as bauxite in consisting largely of aluminum trihydrate (hydrargillite or gibbsite) and is considered to have been formed by the removal of silica and the alkalies from aluminum silicates, such as feldspar, by prolonged leaching in tropical regions. Quartz is unaffected by the process and may remain as discrete particles. Iron hydroxide occurs in concentrations depending on the composition of the parent rock. The texture of this rock in many places is retained in the overlying laterite. The process of laterite weathering is in contrast to that which produces clays; in the latter the texture of the original rock is destroyed, and most of the silica is retained as an aluminum silicate (largely kaolin). Two types of laterite—granite laterite and diorite laterite—were studied in detail. Chemical analyses showed for these respectively, 52.06 and 3.88 percent silica; 29.49 and 49.89 percent alumina; 4.64 and 20.11 percent iron oxide; and 14.40 and 25.98 percent water. If all free quartz is eliminated by mechanical methods, analyses of only the lateritic constituents of the same samples show, respectively, 60.68 and 51.98 percent alumina; 9.56 and 20.95 percent iron oxide; and 29.76 and 27.07 percent water. The author shows the close similarity between such laterites and the Vogelsberg, Germany, bauxite, which he therefore concludes was formed by the weathering of Tertiary basalt under tropical conditions.

The petrography of the granite, syenite, extrusive volcanic rocks, and sedimentary rocks of the Seychelles is described in detail and forms the first part of the paper.

2. Über die Natur des Laterites: Petermanns Mitt., Band. 44, p. 280–283, 1898 [German].

The two kinds of laterite in the Seychelles are described: that which developed on granite and contains free quartz; and that which developed on diorite and is quartz free. Chemical analyses of only the lateritic constituents of these samples showed that in both it is very close to the composition of hydrargillite. The bauxite deposits of the Vogelsberg, Germany, are considered to be a similar weathering product and were derived from the underlying Tertiary basalt.

3. Beitrag zur Kenntnis des Laterits, insbesondere dessen von Madagascar: Neues Jahrb., Festband 100-jahrig. Bestehens, p. 33–90, 1907 [German].

Laterites in Madagascar are described as overlying granite, diabase, amphibolite, and sandstone. Their mineralogic and chemical composition are discussed and chemical analyses included. The iron content is shown to be proportional to that of the original rock. The essential constituent of laterite is considered to be aluminum hydroxide, and the laterites which are composed largely of it are no different from bauxite. However, it is postulated that laterites may also consist of kaolin and other hydrous aluminum silicates which the hydroxide accompanies or replaces. Laterite from other countries is also described.

**Bayer, R. S.**

On a new element extracted from French bauxite (preliminary note): Chem. News, v. 71, p. 128–130, 1895.

The author succeeded in extracting from French bauxite residues a new, unnamed element. It was with difficulty separated from molybdenum and vanadium compounds. The new element in liquid form is violet in the lowest stage of oxidation, and yellow in the highest stage. In this state the substance acts like an acid, corresponding to $R_2O_3$ and gives characteristic compounds with the various bases.

**Beck, William A.**

1. Investigation of the Andersonville bauxite district, Sumter, Macon, and Schley Counties, Ga.: U. S. Bur. Mines, Rept. Inv. 4538, 150 p., 22 figs., 1949.

The Andersonville bauxite district lies in adjacent parts of Sumter, Macon, and Schley Counties in west-central Georgia. A drilling program in the district was begun in Dec. 1941 and continued until Nov. 1943. A total of 1,192 holes were drilled on 121 properties, discovering several new deposits of which four were delimited. In all, about 14,412,000 tons of bauxite and clay that contained more than 30 percent alumina were discovered by the program. Logs of holes and chemical analyses are appended. The areas investigated and the location of drill holes are shown on large-scale maps.

2. Investigation of the Irwinton bauxite district, Wilkinson County, Georgia: U. S. Bur. Mines Rept. Inv. 4495, 16 p., 2 figs., 1949.

In a drilling program during 1942, 62 holes were put down. Bauxite deposits of commercial value were not found in the district although several holes penetrated high-alumina clay. The logs of all holes are included as an appendix. Location of all drill holes are shown on large-scale maps.

3. Investigations of the Springvale bauxite district, Randolph County, Georgia: U. S. Bur. Mines Rept. Inv. 4555, 20 p., 11 figs., 1949.

In a drilling program, in progress from September 5 to November 18, 1943, 390 holes were drilled to a total of 21,285 feet. A short historical sketch shows that bauxite was first discovered in the district in 1916 and was mined intermittently on a small scale until 1922. The ore is generally light gray to buff, pisolitic and oolitic. Logs of all holes are appended. Areas investigated and the location of all drill holes are shown on large-scale maps.

**Behre, C. H., Jr.**

Origin of bauxite deposits: Econ. Geol., v. 27, no. 7, p. 678–680, 1932.

The origin of the bauxite deposits of Arkansas is considered. It is suggested that alteration of the syenite may have continued after the Tertiary sediments were laid down, possibly even until the present. The buried lignite beds overlying residual bauxite are thought to furnish humic acid solutions to continue the

formation of bauxite from syenite in the same manner that thick kaolin beds had been reported by Stejskal to have formed from granite. (*See also* Harder, E. C., 1933).

**Behrend, Fritz.**

Die nützbaren Minerallagerstätten in Nyassaland, section IIb *in* Sonderdruck aus Afrika, Handbuch der praktischen Kolonialwissenschaften, Band 3, Teil 3 p. 48–60: Berlin, Walter de Gruyter u. Cie, 1943.

The bauxite deposits on the Lichenya plateau in the Mlanje Mountains, Nyasaland, are briefly discussed as a part of a paper on the mineral resources of the area.

**Belousov, A. K.**

1. Boksity i diaspor-shamozitovyye rudy zapadnogo sklona Yuzhnogo Urala (Bauxites and diaspore-chamosite ores of the western slopes of the Southern Urals), *in* Boksity, tom 2—Mestorozhdeniya boksitov, priurochennyye k paleozoyskim otlozheniyam (Bauxites, v. 2—Bauxite deposits confined to the Paleozoic): Vses. nauch.-issledov. inst. mineral'nogo syr'ya, Trudy, vyp. 112, p. 70–106, 10 figs., 1 pl. (geol. map), Moscow-Leningrad, 1936 [Russian, English summary].

From the late Silurian through Late Devonian time, numerous series of sandstone, shale, and limestone were laid down along the western slope of the Southern Urals. Bauxite and diaspore are found in two horizons: the Pashiya series at the contact between the middle and upper Devonian; and the Orlovka series in the lower part of the Fransian. The Pashiya series occurs near Kukshik, and on the Ai River near Novaya Pristan. There are two types of ore, the gray-green, and the hard, red jasper-like bauxite. In the Orlovka series, chamosite ores, chamosite-diaspore ores, diaspores, diaspore-hydrohematites, and chamosite-hydrohematite may be distinguished. The material is replaced along the strike by clays and clayey sandstones. Outcrops were found along the banks of the Sim, Katav, and Yurezan Rivers. The bauxite deposits are considered to be littoral, lagoonal sediments.

2. Boksity yuzhnogo Kryla Podmoskovskogo basseyna (The bauxites of the southern part of the Moscow Basin), *in* Boksity, tom 4: Vses. nauch.-issledov. inst. mineral'nogo syr'ya Trudy, vyp. 151, p. 45–101, 21 figs., 1 pl., Moscow-Leningrad, 1939 [Russian, English summary].

Bauxite deposits in the southern part of the Moscow Basin occur in large sink holes which were developed during the "continental period" following the retreat of the sea at the end of the Middle-Upper Tournaisian. The chief minerals in the bauxite are allophane ($Al_2O_3.SiO_2.6H_2O$) and hydrargillite ($Al_2O_3.3H_2O$); jarosite, gypsum, and aluminum sulfates are also found. Titanium oxide is almost completely absent. About 1 to 3 percent of ferric oxide is usual. The largest deposits are about 30–40 kilometers south of Tula along the Upa River. They are 2–3 meters thick and hundreds of meters in diameter.

**Bemmelen, Jakob Maarten van**

1. Onderzoek van eenige grondsoorten uit Suriname, alluviale klei en lateriet: Landbouwk. Tijdschr. p. 315, The Hague, 1903 [Dutch].

2. Beiträge zur Kenntnis der Verwitterungsprodukte der Silikate in Ton-, Vulkanischen- und Laterit-Böden: Zeitschr. Anorg. Chemie, Band 42, Heft 3, p. 265–314, 1904 [German].

Crystalline hydrargillite (gibbsite) is considered to be not only the end product

of subaerial weathering, but it is also the end product in such weathering from an amorphous substance to the crystalline. The hydrargillite occurs as aggregates which show a texture pseudomorphic after the silicates they replace. Tables showing the water content of the iron oxides, the plasticity of laterite, and many chemical analyses are included.

3. De verschillende wijzen van verweering der silikaatgesteenen in de aardkorst: Chem. Weekblad, v. 6, p. 945, 1909, Amsterdam, [Dutch].

4. Die Verschiedenen Arten der Verwitterung der Silikatgesteine in der Erdrinde: Zeitschr. Anorg. Chemie, Band 66, p. 322–357, 1 fig., 1910 [German].

The types of weathering studied are differentiated as (1) the common type, characterized by impure clay; (2) the "sekular", characterized by hydrosols and hydrogels; (3) the lateritic, high in aluminum hydroxide; and (4) that which produces pure kaolin.

**Bemmelen, R. W. van.**

1. Bauxiet in Nederlandsch-Indië: Nederlandsch-Indië Dienst Mijnbouw, Versl. en meded. no. 23, 115 p., 8 figs., 21 pls. (incl. geol. map 1:250,000), Batavia, 1940 [Dutch, English summary].

The two main types of bauxite ("ores . . . of aluminum") are defined as terra rossa, which occurs in the Mediterranean region and consists largely of the monohydrate, and as laterite, which occurs in tropical regions and is characterized by gibbsite.

The origin and occurrence of bauxite on Bintan and neighboring islands in the Dutch East Indies is discussed in detail. The bauxite on Bintan is a lateritic weathering product of a hornfels, containing small crystals of plagioclase feldspar, amphibole, and quartz, which was subject to a long period of lixiviation during the peneplanation of the Sunda continent. Laterite also occurs overlying granite and phyllitic shales; that which overlies granite is very siliceous.

The bauxite consists of hard concretions in a clay matrix. The grade of the ore may therefore be improved by washing to remove the clay. Under the microscope, gibbsite and geothite, in places pseudomorphic after feldspar, were predominant, and these minute crystals were seen to extend outward into the kaolinitic clay matrix. A detailed study of changes with depth was made in a shaft sunk 54 meters deep. Suggestions for further prospecting, mining methods, and many chemical analyses are included.

2. Origin and mining of bauxite in Netherlands India: Econ. Geol., v. 36, no. 6, p. 630–640, 3 figs. (incl. geol. sketch map), 1941.

In 1935, bauxite mining began on Bintan Island. Production figures for the years 1935–1939 are included for Bintan, India, and adjacent regions. Mining methods are briefly described. An average chemical composition is of 53 percent alumina, 2.5 percent silica, 13.5 percent iron oxide, and 1.2 percent titania. The bauxite is the aluminous lateritic type and was derived from a black aphanitic contact-metamorphic hornfels containing feldspar and quartz. The ore consists of layers of hard aluminous concretions in a soft clay matrix. The known reserves of the whole Riau Archipelago are estimated to be between 10 million and 20 million tons. A small-scale geologic map of southeastern Bintan shows the location of bauxite concessions. The location of aluminous laterite deposits and suggestions for further prospecting on the island are also given briefly.

**Bendix, Otto.** See Knecht, Theodoro.

**Berg, Leo S.**

1. On the origin of the Ural bauxites: Akad. nauk SSSR Doklady, v. 46, no. 4, p. 154–156, 1945 [English].

In the Red Cap area in the Ural Mountains, at a latitude of about 60° N., a series of bauxite deposits have been discovered in Devonian limestones. Seven deposits are known over an area 6 km. long, separated by barren areas along the strike. In some deposits a breccia of limestone, cemented by micro-oolitic bauxite, lies between the bauxite and the underlying limestone. The Paleozoic bauxite, like the Mesozoic bauxite described elsewhere, is considered to have been deposited in lakes and swamps on a karst surface. The breccia was formed "by subaerial weathering of the limestone . . . afterwards cemented by bauxite . . ." It is suggested "that the accumulation of alumina in the Ural bauxites has been accomplished by swamp or lake-swamp vegetation."

2. O proiskhozhdenii Ural'skikh boksitov (On the origin of the Ural bauxites): Vses. geog. obshch. Moscow-Leningrad Izv., tom 77, vyp. 1–2, p. 38–64, 1945 [Russian].

The bauxite deposits are considered to have been formed in place in swamps and lakes from alumina extracted from sediments by plant action and possibly also by microorganisms.

3. O proiskhozhdenii Ural'skikh paleozoyskikh boksitov [On the genesis of Paleozoic bauxites in the Urals]: Akad. nauk SSSR Izv., Ser. geol. 1948, no. 2, p. 127–140, 2 figs., Moscow, 1948 [Russian].

**Berger, W. F. B.**

Bauxite in Arkansas: Eng. Min. Jour., v. 77, p. 606–607, 2 figs., 1904.

Mines are opened on gently sloping hillsides where drainage is simple. The ore is blasted out and shoveled into wagons. Tram tracks are shifted as the face is moved back. For the alum industry, the ore is crushed and air dried; for the low-silica abrasive industry, the ore is first washed in a log-washer. The status of the industry in general in the United States is reviewed.

**Bergquist, Harlan R.** *See also* Goldich, Samuel S.

Geology of the Margerum bauxite district, Alabama; text is on the same photostat sheet as a map entitled Geologic map of the Margerum bauxite district, Colbert County, Ala.: U. S. Geol. Survey Strategic Minerals Inv. Prelim. Map, scale 1:20,000, May 12, 1943.

A detailed geologic map of a part of Colbert County, Alabama, shows the location of bauxite deposits and proposed test holes. A brief text includes a description of the stratigraphic units, the bauxite, and its stratigraphic position, the average known chemical composition of bauxite in this district, and makes a preliminary estimate of reserves.

**Berkelhamer, Louis H.**

An apparatus for differential thermal analysis: U. S. Bur. Mines Rept. Inv. 3762, 17 p., 9 figs., 1944; U. S. Bur. Mines Tech. Paper 664, p. 38–55, 9 figs., 1945.

The details of the construction and operation of an inexpensive differential thermal analysis machine are presented. Curves of clay minerals and related iron and aluminum compounds are figured.

**Berthier, P.**

1. Examen du fer forgé par les Nègres du Fouta Diallon (Haut-Sénégal) et des minerals desquels ils le retirent: Annales mines, tome 5, p. 129–134, 1820 [French].

Analysis of a sample of rock from Fouta Diallon, Sénégal, showed 33.6 percent iron oxide, 40 percent alumina, 2 percent silica, 24.7 percent water, and a trace of chromium and manganese oxides. It is considered that the sample is a mixture of a hydrate of alumina, a little clay, iron oxide, and hydrous iron oxide. It was not possible to deduce the chemical formula of the hydrate of alumina.

2. Analyse de l'alumine hydratée des Beaux, département des Bouches-du-Rhône: Annales mines, tome 6, p. 531–534, 1821 [French].

This paper records the first discovery of an aluminum hydrate in nature. A sample from what appeared to be an alluvial iron ore deposit, upon analysis, was found to be a mixture of the hydrate of aluminum and red iron oxide. After lime had been removed, the constituents were determined to be 52 percent alumina, 20.4 percent water, 27.6 percent iron oxide, and a trace of chromium oxide. The "minerai des Beaux" was considered to contain, in part, a hydrate of alumina with two molecules of water, or 72 percent alumina and 28 percent water. The deposit cropped out on a small hill called the "collîne des Beaux", not far from Arles, France. The substance was not named by the author.

**Bevan, Arthur.**

1. Virginia's war mineral resources: Va. Geol. Survey, Repr. ser., no. 4, 18 p., 1942.

*Bauxite, pages 16 and 17.*—In 1941 the Republic Mining and Manufacturing Co. began to ship ore from two mines northwest of Spottswood, southern Augusta County. Many other smaller deposits are known, but they are not large enough for commercial exploitation.

2. Note on geomorphic relations of Virginia bauxite deposits [abs.]: Va. Acad. Sci. Proc. 1943–1944, p. 63–64, [1944].

The bauxite deposits of Augusta County are associated with much larger masses of white clay which overlie steeply tilted Lower Ordovician and Upper Cambrian limestone and dolomite. The bauxite and clay deposits appear to be related to the physiographic development of the Shenandoah Valley. It is suggested that the clays were deposited in caverns, and that kaolinization and bauxitization are probably related to the recent geomorphic history of the valley.

**Beyschlag, F.**

1. Bauxitvorkommen in Bihargebirge: Deutsche geol. Gesell. Zeitschr., Band 70, Nr. 1–4, Monatsber., p. 10–15, 1918 [German].

This is a very brief general description of the bauxite deposits in the Bihar Mountains, Hungary [now Rumania], with discussion by Krush, Oppenheim, and Jentzsch.

2. Neuere Beobachtungen an den Bauxitlagerstätten des Bihar-Gebirges in Ungarn: Zeitschr. prakt. Geologie, 26 Jahrg., Heft 3, p. 35–40, 5 figs., 1918 [German].

Bauxite was discovered in the Bihar Mountains, Hungary [now Rumania], in 1906 by P. Krusch. The bauxite lies on an irregular surface of the upper Jurassic limestone and is overlain by concordant beds of lower Cretaceous limestone. In places the strata have been subsequently tilted and faulted, so that the bauxite deposits occur in a series of offsets. The bauxite is considered to represent a

weathering product in a coastal area during Late Malm (Late Jurassic) and Early Cretaceous time.

**Bezrukov, P. L.**

1. and Yanshin, A. L. Yurskiye otlozheniya i mestorozhdeniya boksitov na Yuzhnom Urale (Jurassic rocks and bauxite deposits in the South Urals): Nauch.-issledov. inst. geologii i mineralogii Trudy, vyp. 7, 100 p., 2 figs., 3 pls., 1934 [Russian, English summary].

In the southern part of the Ural Mountains a lateritic weathering crust on Paleozoic rocks is overlain by sediments formerly thought to be Neogene in age, but herein shown to be Jurassic. "Bean" lateritic ore discovered near the edge of the Jurassic, near the village of Perevolochensky, is half a meter to 3½ meters thick and analyzes approximately 7–17 percent silica, 23–38 percent alumina, and 20–44 percent iron oxide. The "beans" are composed largely of diaspore and hematite, but the cement is hydrargillite, diaspore, and hydrohematite. Reserves are estimated to be 1,370,000 tons.

2. Yurskiye otlozheniya i mestorozhdeniya alyuminiyevykh rud v Primugodzharskikh stepyakh (The Jurassic sediments and aluminum ore deposits in the Mugodjar Steppes), *in* Boksity, tom 1— Mestorozhdeniya boksitov, priurochennye k mezozoyskim otlozheniyam (Bauxites, v. 1—Bauxite deposits confined to the Mesozoic): Vses. nauch.-issledov. inst. mineral'nogo syr'ya Trudy, vyp. 110, p. 75–162, and 164–167, 18 figs., 1 pl., Moscow-Leningrad, 1937 [Russian, English summary].

Eight deposits of pisolitic bauxite were discovered in the course of a study of the tectonic history and stratigraphy from the Jurassic through the Tertiary in the Mugodjar Steppes. The deposit near Orsk is the most important; the ore contains 41–49 percent alumina and 4–14 percent silica. Four types of bauxite are described: (1) pisolitic iron ores and ferruginous bauxite, (2) light colored argillaceous bauxite, (3) white pisolitic rock, close to kaolin in chemical composition, and (4) alunite pisolitic rock. It is considered that the bauxite was precipitated in stagnant lake waters due to a change in acidity of streams when they emptied into the lake. The age of the deposits is Jurassic.

**Bingham, Mason L.** *See* Allen, Niel R.

**Bischof, C.**

Analysis of bauxite: Metall. Rev., v. 2, p. 523; abs., Berg- u. hüttenm. Zeitung, Jahrg. 37, p. 196, 1878.

**Bishopp, D. W.**

Memorandum on the occurrence of bauxite in British Guiana: British Guiana Geol. Survey Bull. 8, 68 p., 1 pl. (geol. map, scale 1:1,000,000), 1938.

From unpublished reports and other documents, a report has been compiled that includes a detailed description of the bauxite deposits of the country together with estimates of reserves, chemical analyses, names of property owners, and production, if any. The areas studied are the lower Essequibo River, the Demerara River, the Berbice River, the Corentyne district, and the North-West district. In the technical section of the paper, the results of valuable work by J. B. Harrison on the geology and the formation of bauxite are included. A field test used by Harrison to distinguish between bauxite and lithomarge is that of drying the sample at 110° C, and then heating it to a low red heat (420° C) and noting the loss of water by weighing. Gibbsite loses most of its water below

that temperature, but kaolin loses none. A geologic map shows the location of bauxite deposits.

**Blackwell, George G.**

Notes on bauxite of County Antrim: Manchester Geol. Soc. Trans., v. 22, p. 525–527, 1894.

Bauxite in the North of Ireland was probably first discovered in 1870 by A. Sutherland. By 1894, it was used in the manufacture of paper, alum-cake, refractory brick, and in the sugar beet industry. A large deposit containing 54 percent of alumina and 1.5–1.75 percent of iron was delimited. A shaft mine was opened which it was estimated could probably produce about 2,000 tons of ore a week.

**Blake, G. S.**

(and Crook, T.) Laterites from the Central Provinces of India: Imp. Inst. Bull., v. 7, p. 278–285, London, 1909.

Chemical analyses of samples of laterites from the Central Provinces, India, showed them to be commercial grade bauxites, but it is not considered that such material has a high enough value per ton to be able to compete at European and American ports with bauxite from other places.

**Blake, William P.**

Alunogen and bauxite of New Mexico: Am. Inst. Min. Eng. Trans., v. 24, p. 571–573, 1894; abs., Am. Geologist, v. 14, p. 196, 1894.

It was thought that horizontal strata of highly altered volcanic rock, originally basic porphyries and basalts, had been decomposed by solfataric action to form an outer deposit of alunogen (sulfate of aluminum), and an inner mass of residual bauxite in place. At the time of writing, the amount of silica and alkalies had not been determined, but partial analyses showed about 20 percent loss on ignition, which was considered to indicate that the inner mass was bauxite. Globular, concretionary structures occurred in both the inner and outer parts of the deposit.

**Blanford, W. T.**

Note on the laterite of Orissa [India]: India Geol. Survey Mem., v. 1, p. 280–294, 1859.

The mode of occurrence and the physical character of the laterite are described.

**Blumenthal, Maurice M.**

1. Esquisse de la géologie du Taurus dans la region de Namrun (Vilâyet d'Içel) et le gisement de bauxite découvert dans ces parages: Maden tetkìk ve arama, sene 5, sayi 4/21, p. 558–570, 2 pls. (geol. map 1:172,000 and sections), Ankara, 1940 [Turkish and French].

Bauxite occurs as scattered deposits in the basal conglomerate of the lacustrine-lagoonal deposits of Oligocene age in the gorge between Namrun and Sarikavak in the Bolkar Dag chain of the Taurus Mountains, Turkey. This occurrence is of no great economic importance as there are only a few hundred tons of bauxite. The most important group of deposits in the region is 2–3 kilometers northwest of Sebilkoyu and about 5 kilometers west-southwest of Namrun. The bauxite occurs sporadically, as a secondary, alluvial deposit. It is red, pisolitic, and in some places the pisolites are cemented together in irregular masses, but rarely as

large as an apple. Chemical analyses show an average of 8.47 percent silica, 53.15 percent alumina, 25.35 percent iron oxide, and 2.56 percent titania.

2. Un gisement de bauxite dans le permo-carbonifère du Taurus oriental: Maden tetkìk ve arama, sene 9, sayi 2/32, p. 218–225, 1 fig. (geol. sketch map), Ankara, 1944 [Turkish and French].

Pisolitic bauxite southwest of Kân, in the eastern Taurus Mountains, Turkey, occurs in the Permo-Carboniferous limestones. Analyses of the material indicate about 46 percent alumina, 22 percent iron oxide, and 15 percent silica. The geology of the region and the origin of the bauxite are discussed.

**Böhm, J.**

Über Aluminium und Eisenhydroxide: Zeitschr. anorg. allg. Chemie, Band 149, Heft 1–3, p. 203–216, 1 fig. 1925 [German].

X-ray diffraction patterns of a number of samples of bauxite indicated that aluminum hydroxide occurs in three forms in nature: diaspore and bauxite, the monohydrate forms: and hydrargillite, the single trihydrate form. Goethite and rubinglimmer are the monohydrates of iron. The term bauxite as used herein refers to the principal mineralogic constituent of certain bauxites and is shown to be a monohydrate similar to diaspore; it is not named by the author.

The author shows also, by similarity of X-ray patterns, that diaspore and goethite are homologs. (See de Lapparent, 1927, tome 184, p. 1161–1162.)

**Boichenko, Ye. A.** *See* Vinogradov. A. P.

**Bole, G. A.** *See* Stull, R. T.

**Bonnalt, D.**

Le rôle de la latérite dans les formes du relief des environ de Bondoukou (Côte d'Ivoire): French West Africa Service mines Bull., no. 2, p. 51–52, 2 pls. (geol. and topo. maps, scale 1:250,000), Dakar, 1938 [French].

In the vicinity of Bondoukou in the Ivory Coast, the ferruginous laterite cover is found to be much thicker where it overlies the group of metamorphosed basic rocks than where it overlies the granite. Although the granite areas may have been topographically higher in the past, the thicker laterite on the basic rocks has resisted erosion, and such areas now appear as a series of plateaus at the same elevation.

**Bonnet, Juan Amedée.**

The nature of lateritization as revealed by chemical, physical, and mineralogical studies of a lateritic soil profile from Puerto Rico: Soil Sci., v. 48, no. 1, p. 25–40, 1939.

Chemical analyses, base exchange capacity, and mineral identification of samples from a 20-foot section of the Catalina clay soil in Puerto Rico showed some accumulation of the sesquioxides in the upper part. Low content of silica was due to its partial removal in an early stage of weathering, and the presence of considerable quantities of sodium was probably a factor in increasing the solubility of the silica. Tests on igneous rock of several types were made to determine the amount of silica dissolved by plain and carbonated water. A comprehensive bibliography is appended.

**Born, Kendall E.**

Summary of the mineral resources of Tennessee: Tenn. Div. Geology Res. Tenn., 2d ser., 1936, 102 p., 4 illus., 1936.

*Bauxite, p. 43–44.*—Bauxite occurs in Tennessee at the foot of Lookout Mountain in East Chattanooga, at Hixon, Hamilton County, and near Elizabethton. Carter County. One of the largest aluminum plants in the country is located at Alcoa, but most of the ore used is imported or shipped in from Arkansas.

**Bowles, Edgar O.**

The geology and mineral resources of Cherokee County, Ala.: Ala. Geol. Survey Cir. 15, 38 p., 27 figs., 1941.

*Bauxite, p. 23–27.*—The bauxite deposits of Cherokee County occur in the eastern part of the Coosa Valley in low hills adjacent to the Indian Range. Most of the deposits occur stratigraphically near the top of the Conasauga formation (Upper Cambrian), but a few also occur in the Shady limestone and the Chepultepec and Copper Ridge dolomites (Cambrian and Ordovician). Brown iron ores are found in the deposits; clay is also associated with bauxite and in some places occurs as "horses" within the deposits. Chemical anaylses are included. The known bauxite deposits of the county are listed and precisely located by quarter quarter sections.

**Bracewell, Smith**

The geology and mineral resources of British Guiana, *in* The Handbook of natural resources of British Guiana: 40 p., 3 pls. (incl. min. res. and geol. sketch map), Georgetown [Demerara], British Guiana Int. Devel. Comm., 1946.

A general study covering the geology of the crystalline areas and the much later sedimentary deposits, together with a description and evaluation of the important mineral resources—gold, diamonds, and bauxite.

**Braile, Nicolau.** *See* Feigl, Fritz.

**Bramlette, M. N.**

1. Geology of the Arkansas bauxite region: Ark. Geol. Survey Inf. Circ. 8, 68 p., 9 pls. (incl. geol. map and sections), 1936.

The bauxite deposits of Arkansas are restricted to two areas, the larger, near the town of Bauxite, Saline County, and the other just southeast of Little Rock, Pulaski County. In these areas the bauxite was derived from nepheline syenite by subaerial weathering. Between these two areas, thin deposits of bauxite high in silica and iron occur along the unconformity between the Midway and Wilcox groups of Eocene age. It is considered that bauxite was formed during this interval by the profound weathering of the old land surface; and that a blanket of bauxite might have formed on the syenite projecting above the old surface, but would not have formed below the surface. The bauxite beds overlying the Midway sediments are either transported deposits or were derived from the weathering of feldspar sands within the Midway.

During the investigation, 55 holes were drilled. The areas where new deposits may be found, and the approximate depths, are indicated by the geologic map. Reserves are estimated to be about 11.6 million tons.

2. Lateritic ore of aluminum in the Greater Antilles (abs.): Geol. Soc. America Bull., v. 58, no. 12, pt. 2, p. 1248–1249, 1947.

"Much of the surficial red earth of Jamaica is an aluminous laterite with a sufficient available alumina content to be of commercial interest. The laterite forms extensive blanket deposits on the early Tertiary limestone, with the thickest deposits in depressions of the karst topography." [Complete abs.]

**Branner, George C.**

1. Outlines of Arkansas' mineral resources: 352 p., 24 figs., 10 maps, Ark. Bur. Mines, Manufactures, and Agriculture *and* Ark. Geol. Survey, 1927.

*Bauxite, p. 69–77.*—This outline of the bauxite deposits of Arkansas includes chemical analyses and brief sections on uses, geology, mining methods, history, production, and operating companies.

2. The Arkansas bauxite deposits, *in* Mining districts of the eastern States: Internat. Geol. Cong., 16th Sess., United States, 1933, Guidebook 2, Excursion A–2, p. 92–102, 4 figs., 2 pls., 1933.

The bauxite deposits in Saline and Pulaski Counties, Ark., are the result of the weathering of intrusive nepheline syenite and are composed of both residual and transported materials. Underground and strip mining methods are used; the underground, first used in 1924, was the more important by 1930. A brief discussion of production and reserves is included.

3. Current bauxite mining activities in Arkansas: Mining and Metallurgy, v. 16, no. 339, p. 123–124, 5 figs., 1935; Abs., Am. Inst. Min. Metall. Eng. Yearbook, p. 22, 1935.

Bauxite is mined in two districts in the central part of the State of Arkansas: (1) the Fouche Mountain district south and southeast of Little Rock in Pulaski County; and (2) the Bauxite district about 5 miles east of Benton, Saline County. Open-pit mining is the most common method, and, until 1924, was used exclusively; however, in 1930, about 60 percent of the ore was produced from underground mines. In 1935, five companies were in operation—the Republic Mining and Manufacturing Co., the Dixie Bauxite Co., American Cyanamid and Chemical Co., the Crawford Bauxite Co., and the William J. Crouch Mining Co.

4. Are our aluminum ore reserves adequate: Mining and Metallurgy, v. 22, no. 415, p. 351–353, 2 figs., incl. geol. map, 1941.

Reserves in the United States of ores that contain 55 percent or more of alumina are about 11 million long tons, or 15 years' supply at the 1937–39 rate of consumption. An additional 9 million long tons of ore containing 50 percent alumina is available, or 13 years' additional supply.

5. The mineral resources of Arkansas: Ark. Geol. Survey Bull. 6, 101 p., 12 graphs, 14 figs., 1942.

*Bauxite and aluminum, p. 34–36.*—This paper contains a brief statement of the occurrence of bauxite in Arkansas, the history of its development, prices, production, and reserves.

**Branner, John C.**

1. Bauxite in Arkansas: Am. Geologist, v. 7, no. 3, p. 181–183, 1891; abs., Science, v. 17, p. 171, 1891; Eng. Min. Jour., p. 114, 1891.

A brief description is given of the newly discovered bauxite deposits in Saline and Pulaski Counties, Ark. The deposits vary from a few feet to over 40 feet in thickness and occur in areas of Tertiary sediments near the "eruptive syenites" to which they are considered to be genetically related. Partial analyses of eight samples are included.

2. A Letter to His Excellency, J. P. Eagle, Governor, Jan. 7, 1891: Correspondence in Ark. Gazette and Ark. Democrat, Jan. 8, 1891; Ark. Press,

intermittently from Jan. 18, 1891, until 1893; Ark. Bur. Mines 3d Bienn. Rept., 1893, and 4th Bienn. Rept., 1894, p. 119–126.

This letter announces the discovery of bauxite in Arkansas. The deposits occur only in areas underlain by Tertiary sediments and in the vicinity of igneous rocks. The deposits are irregular in thickness and extent and have been found only at altitudes of 300 feet or less. The known bauxite deposits cover an area of 640 acres in Saline and Pulaski Counties. Bauxite varies in color, character, composition, and value. All known deposits and outcrops are described and chemical analyses of samples are included.

3. The bauxite deposits of Arkansas: Jour. Geology, v. 5, p. 263–289, 2 pls., 2 figs., 1897.

Chemical analyses show a complete gradation from bauxite, consisting largely of aluminum hydrates, to clay. In Arkansas, bauxite occurs only in sediments of Tertiary age and in the vicinity of syenite to which it is considered to be related. The Arkansas bauxites are concluded to be the result of the action of hot waters. The size and extent of the deposits are described. The uses of bauxite as a refractory material are given.

4. The bauxite deposits of Arkansas: 38 p., illus., pamph., Chicago, Univ. of Chicago Press, 1897(?).

**Brewer, William M.**

1. The Warhoop bauxite bank, Ala.: Eng. Min. Jour., v. 55, p. 461, 1 fig., 1893.

The Warhoop Bank bauxite deposit was opened in 1892 and in 1893 was being mined by the Republic Mining and Manufacturing Company. The changes in grade of ore across the deposit were shown to be due to the presence of one or more clay horses. Development of this deposit and the nearby Washer Bank deposit was progressing, but neither was yet completely delimited.

2. Bauxite: Mineral Industry, 1895, v. 4, p. 49–50, 1896.

Data are given on domestic production by States, imports, and consumption, 1890–95. Companies and the mines in operation are named.

3. Bauxite: Mineral Industry, 1896, v. 5, p. 51–54, 1897.

Data are given on domestic production by States, imports, and consumption, 1892–1896. Companies and mines in operation as well as new discoveries in 1896 are discussed.

**Bridge, Josiah.**

1. (and Dorsh, John B., and Weitz, John H.) Bauxite and other sources of aluminum, *in* Mineral position of the United States, Appendix to investigation of national resources: U. S. Cong., Senate, 80th Cong., 1st Sess., Hearings Subcomm., Comm. Public Lands, May 15, 16, and 20, 1947, p. 217–224, U. S. Govt. Printing Office, 1947; *also in* Mineral Resources of the United States, Chap. 14, p. 63–71, Washington, D. C., Public Affairs Press, 1948.

Measured, indicated, and inferred reserves of bauxite in the United States are estimated to be slightly less than 60 million long tons. The ore contains not more than 15 percent silica and 6 percent FeO, and not less than 40 percent alumina, 32 percent of "available alumina". The estimates include only ore in deposits more than 8 feet thick. Location of districts is shown on a small-scale map. Estimates of the reserves of low-grade bauxite, bauxitic and high-alumina clays, and alunite are also included. The amount of aluminum recoverable from all these sources, without regard to cost, is estimated to exceed

350 million short tons. Production, consumption, and prices of bauxite and aluminum for 1910–45 are shown by graphs.

2. (and Goldich, Samuel S.) Preliminary report on the bauxite deposits of Babelthuap Island, Palau Group: U. S. Far East Command GHQ Tokyo. Office of Engineer Rept., 46 p., 11 pls., 5 figs., Jan. 1948.

The principal deposits of bauxite in the Palau Island group occur in the Ngardmau district in the northwestern part of Babelthuap Island. The bauxite was derived from the weathering of volcanic agglomerate and is of two types—the surface bauxite gravel and the "deep-seated" dark reddish brown clay containing hard masses of bauxite. Gibbsite and hematite are the predominant minerals in the bauxite; boehmite and goethite occur in minor amounts. The clay consists largely of kaolinite and endellite. The average composition of washed ore is 51 percent alumina, 16 percent iron oxide, 2.5 percent silica. The area was mined by the Japanese between 1938 and late 1944; 322,418 metric tons of concentrate were produced. Japanese mining operations used manual labor almost exclusively, although gasoline engines were used to haul trains of ore cars. Water sprays and log washers were used to concentrate the nodular ore. An aerial tramway 1.3 miles long was used to transfer the concentrate to a lighter pier.

3. On the occurrence of bauxite on Truk: Pacific Sci., v. 2, no. 3, p. 223–224, 1948.

The only known bauxite deposit in the Truk Island group, in the Pacific, is on Moen Island in a small area at the top of Mount Witipon (Takeun). The bauxite occurs as small, irregular nodules in a light yellowish-buff clay which rests on and was derived from a trachytic flow. The trachyte is not known to occur elsewhere in the group. The results of thermal analysis indicated that the bauxite contained about 60 percent gibbsite; chemical analysis showed about 53 percent alumina, 30 percent water, 9 percent silica, and 7 percent iron oxide. The deposit is too low in grade and too small to be of economic importance.

4. Bauxite deposits of the Southeastern United States, *in* Snyder, F. G., Symposium on mineral resources of the Southeastern United States, p. 170–201, 7 figs., 1 pl., Knoxville, Tenn., Univ. Tenn. Press, 1950.

The principal deposits of bauxite in the southeastern States occur in Alabama and Georgia; other deposits are found in Tennessee, Virginia, and Mississippi. Bauxite was first discovered in the United States in Floyd County, northwestern Georgia about 1883, the first published notice appeared in 1887, and mining began in 1888. Until 1898, all United States production came from the Appalachian districts of Alabama and Georgia. The now more important deposits of the Coastal Plain in Alabama and Georgia were not discovered until 1923–24 and 1912, respectively. Reserves in these five southeastern States are estimated to be 1,739,000 long tons, or about 1.5 percent of that for the country as a whole. Bauxite from these districts was used in the past in the manufacture of alum and metallic aluminum, but it is now primarily used in the chemical, abrasive, and refractory industries. A table shows specifications of ore to be used for various purposes.

It is concluded from a study of the geology and physiography of the region that these bauxite deposits were all formed during the interval between the Paleocene and Eocene epochs; that they had a common source of material—weathered crystalline rocks in the present Blue Ridge and Piedmont provinces; and that streams flowing from these areas onto the Harrisburg peneplain and onto a coastal plain of the same age carried this finely divided weathered material in suspension and deposited some of it in sinks and depressions on the peneplain surface in the Appalachian region, and some of it on the erosion surface in the

Coastal Plain. That these two erosion surfaces were contemporaneous is made evident by the presence of lignite and fossil plants, and by the geology and paleontology of the Coastal Plain.

**Bryson, Robert P.**

(and Gordon, Mackenzie, Jr., Parmelee, E. Bruce, and Shelton, Richard C. Arkansas bauxite district, Saline and Pulaski Counties, Ark.: U. S. Geol. Survey Strategic Minerals Inv. Prelim. Map, scale 1:48,500, May 9, 1944.

A brief text and a map showing the geology, bauxite mines, and subsurface contours on the post-Midway erosion surface of the bauxite district in Saline and Pulaski Counties, Ark., are printed on one sheet. The text includes a description of the bauxite, the parent rocks, and the location of the deposits with relation to the topography of the post-Midway erosion surface, and to the stratigraphic succession. Estimates of reserves of bauxite and high-alumina clay are made for the area as a whole.

**Buchanan, Francis.**

A journey from Madras through the Counties of Mysore, Canara, and Malabar: 3 v., London, 1807.

The "clay" used in India for making bricks because it hardened on exposure to the air was originally described in these volumes; it was called laterite by the author because of this property. References to the material are on pages 436–437, 440–441, 460, and 559 in volume 2; and on pages 66, 89, 251, and 258 in volume 3.

**Burchard, Ernest F.** *See also* Thoenen, John R.

1. The production of bauxite and aluminum: U. S. Geol. Survey Min. Res. U. S., 1906, p. 501–510, 1907.

Statistics of domestic and world production and consumption of bauxite and aluminum include 1906 and past years. The areas being mined in the Appalachian and Arkansas bauxite districts are described. A section is devoted to the undeveloped deposits reported in Nevada and New Mexico.

2. Bauxite associated with siderite: Geol. Soc. America, Bull., v. 35, no. 3, p. 437–448, 1924; abs., v. 35, no. 1, p. 109, 1924, and Pan-Am. Geologist, v. 41, no. 2, p. 153–154, 1924.

Bauxite in northeastern Mississippi occurs in the lower part of the Eocene near the contact between the Ackerman formation (Wilcox group) and the Porters Creek clay (Midway group). Although the bauxite is not uniform in physical or chemical characteristics, two types can be recognized: hard, or rock bauxite; and soft, clay-like material. The hard bauxite consists largely of pisolites, and also has a higher iron content. Much of the iron is in the form of crystalline siderite which in many places lines cavities. Dense, fine-grained siderite also occurs in lenticular masses below, and interbedded with, the bauxite.

3. Bauxite in northern Mississippi: U. S. Geol. Survey Bull. 750, p. 101–146, 3 figs., 1925.

The bauxite in northeastern Mississippi occurs in a group of about 60 small deposits in a belt 3–5 miles wide and extending 150 miles in a gentle arc from north to southeast. Stratigraphically they occur in the lower part of the Ackerman formation (basal Wilcox) and vary greatly in composition, character, and size. It is suggested that the bauxite was probably laid down in fresh water, largely peat swamps, and probably was not due to subaerial weathering. These deposits overlie a thick bentonite clay. The deposits are described by counties.

Reserve estimates by grade show little material suitable for the metallurgical, chemical, refractory, or abrasive industries.

4. Discovery of bauxite in Mississippi: Eng. Min. Jour.-Press, v. 119, no. 6, p. 235, 1925.

J. W. Adams discovered the bauxite deposits of Mississippi in 1921 as a result of a study of the geologic literature on the State, especially a report by Hilgard in 1860. Although he did not recognize it as such, Hilgard described bauxite so accurately that Adams was able to recognize the rock and to rediscover the deposits.

5. The Pao deposits of iron in the state of Bolivar, Venezuela: Am. Inst. Min. Metall. Eng. Tech. Pub. 295, 27 p., 12 figs. (incl. maps and thin sections), 1930.

The Pao iron ore deposits occur near Upata, about 30 miles south of the Orinoco River and 90 miles east of Ciudad Bolivar. In many places the surface is covered with float ore, called canga. The surface canga is largely iron oxides, but below the surface there is also a bauxitic canga which ranges from nearly pure, pisolitic bauxite to ferruginous bauxite. The thickness ranges from 10 to 76 feet, although in one drill hole 115 feet of iron ore canga was reported.

**Burton, R. C.**

On the origin of the laterite of Seoni, Central Provinces [India]: India Geol. Survey Rec., v. 48, pt. 4, p. 204–218, 1917.

The laterite discussed is the high-level type which lies between 1,900 and 2,100 feet above sea level. It directly overlies Deccan trap, Intertrappean chert, and the gneissic complex. The laterite is thought to be "probably partly a chemical and partly a detrital lake deposit." The oolitic and pisolitic textures may be the result of the deposition of sediment from solution; the cellular laterite is "mainly formed from detritus derived from the Deccan trap and carried into a lake."

**Burtzev, D. N. (Bertsev).**

Ob otkrytii boksitov i porod problematicheskogo vozrasta v Turgayskoy vpadine (On the discovery of bauxites and rocks of problematic age in the Turgai Depression): Problemy Sovetskoy geologii, tom 8, no. 1, p. 87–88, 1938 [Russian].

**Butts, Charles.**

(and Gildersleeve, Benjamin). Geology and mineral resources of the Paleozoic area in northwestern Georgia: Ga. Geol. Survey Bull. 54, 176 p., 8 pls., 15 figs., 2 maps, 1948.

*Bauxite, p. 86–89.*—The location of deposits and the types of ore in the several bauxite districts of northwestern Georgia are briefly described. Because of the irregular distribution of the ore pockets, no estimate of reserves is possible, although many of the worked deposits appear exhausted.

**Bykov, G. Ye.**

O vozraste boksitov Severo-Vostochnogo Kazakhstana (On the age of bauxites in northeastern Kazakhstan): Problemy Sovetskoy geologii, tom 8, no. 1, p. 73–76, 1938 [Russian, English summary].

The bauxite deposits of northeastern Kazakhstan may be divided into two groups: those assigned to the Tertiary on the basis of the associated flora in the Akmalinsk and Atbasar regions; and those of Mesozoic age found farther west in the Ural Mountains.

**Calafat León, Juan.**

Sobre los nuevos yacimientos de "bauxita" en España: R. Soc. Española historia nat. Bol., tomo 17, p. 415–418, 1917 [Spanish].

The occurrence of bauxite in Cataluña and Barcelona provinces, between Mediona and La Llacuna stations, is announced and briefly described. The concessions already granted are listed.

**Calatayud, José R. Bataller.** *See* Bataller Calatayud, José R.

**Callot. T.**

Note on the aluminum industry in France: Eng. Min. Jour., v. 89, p. 1229–1230, 1 fig., 1910.

The principal bauxite deposits in France occur in the Départements of Hérault, Bouches du Rhône, and Var, all in southern France. In Hérault the deposits are irregular, and the grade varies greatly from place to place; in Bouches du Rhône, the deposits are high in silica; the best ore occurs in Var, whence it is shipped with a guarantee of 60 percent $Al_2O_3$ and less than 3 percent $SiO_2$.

**Campbell, J. Morrow.**

1. The origin of laterite: Inst. Min. and Metallurgy Trans., v. 19, p. 432–457, 3 figs., 1910.

On gentle slopes, laterite is formed above the ground-water level by the gradual removal of some or most of the mineral constituents of either alluvium or rock in place and by the deposition of ferric and aluminous hydrates from solution in waters rising from below. Place of deposition of iron and aluminum is determined by contact with oxygen of the atmosphere. In Haute Guinée laterite that caps flat-topped hills 1,300 to 1,600 feet above the surrounding country is considered to have formed when the summits were part of a low-lying slope.

2. Laterite, its origin, structure, and minerals: Min. Mag., v. 17, no. 2, p. 67–77, 1 fig.; no. 3, p. 120–128; no. 4, p. 171–179, 18 figs. (incl. microphotographs); no. 5, p. 220–229, London, 1917.

"Alteration" of crystalline rocks (changes taking place below the ground water level) is more rapid and intense in warm climates than in cold, and the end product is largely hydrous aluminum silicates. "Weathering" of rocks (changes taking place above ground water level) is more rapid in cold climates than in warm, but the end product is also hydrous aluminum silicates. Laterization is the process by which iron, aluminum, and titanium hydroxides are deposited within a porous material near the surface. Both iron and aluminum are considered to be deposited from solution in vadose waters. By definition, a rock is not considered a laterite unless it contains free aluminum hydroxide. Unaltered or impermeable rock is incapable of being laterized. Secondary changes in laterite are usually toward hydration of alumina and dehydration of iron.

**Capper Alves de Souza, Henrique.** *See* Paiva, Glycon de.

**Carnot, Ad.**

Minerais de fer de la France, de l'Algérie et de la Tunisie: Annales mines Mém., 8e sér., tome 18, p. 5–163, 1890.

This paper on the iron ores of France, Algeria, and Tunisia does not mention bauxite, and in many of the chemical analyses the percentages of alumina and silica are given together. Pages 15–163 are devoted to chemical analyses. This paper has been cited in bibliographies on bauxite but has no direct bearing on the subject.

**Carroll, Dorothy.**

1. The mineral resources of Western Australia: 5th ed., 27 p., 8vo., 29 photographs, 1 map, Western Australia Govt. Mineralog. Chem. Labs., Perth, 1945.

*Aluminum, p. 12–13.*—The bauxitic laterites of Western Australia occur in various parts of the State but are most extensive along the Darling Plateau in a belt about 250 miles long, parallel to the coast line. The laterite capping averages about 3 feet in thickness and may overlie granite, dolerite, or metamorphosed rocks. The only commercial use of the laterite has been as road ballast, although at several of the localities listed, samples of high-grade ore were collected that contained 50–52 percent of alumina.

This compilation has a short section on each of the minerals present in quantity in Western Australia and is designed as a nontechnical publication.

2. (and Jones, Neal K.) Laterite developed on acid rocks in southwestern Australia: Soil Sci. v. 64, no. 1, p. 1–15, 1947.

Three typical high-level lateritic soil profiles overlying gneissic and granitic rocks were studied in detail. The areas, Wongon Hills, Greenbushes, and Rocky Gully, lie at the western edge of the high plateau, southwesternmost Australia, at elevations of about 1,000 feet. The underlying rock is typically weathered into a profile, from top to bottom, of the following: (1) sand or sandy soil; (2) massive laterite, generally pisolitic; (3) lithomarge, red and white, cream, or gray; (4) kaolinized rock, which may or may not show original rock structure.

Each unit of each profile was sampled. Chemical analyses show total, free, and combined silica, total and soluble alumina, combined and hygroscopic water, and iron, titanium, manganese, calcium, magnesium, and phosphorous oxides. The essential mineral composition is of clay minerals (largely kaolinite), quartz (angular and subangular), a mixture of gibbsite and diaspore, and iron minerals such as turgite. The gibbsite-diaspore mixture is possibly due to partial dessication of gibbsite in an arid climate. The accessory minerals are residual from the parent rock.

The laterites, post-Miocene in age, formed under warm and humid climatic conditions; the area was subsequently uplifted and is now being eroded. The stages in the disintegration of the profile—largely by leaching—are: (1) the matrix of the massive laterite at the top of the profile is removed gradually, thus resulting in a surface covering of loose fragments and single pisolites; (2) the remainder of the laterite unit is removed, leaving lithomarge overlain by surface sand and residual pisolites; (3) the lithomarge may then also be reduced in thickness so that the sand and pisolites are close to the underlying, kaolinized rock. Present-day soils may have formed on any one of the units of the profile; those formed on kaolinized rock where the laterite capping has been removed are relatively fertile, those forming from the laterite, infertile.

**Casetti, M.**

La bauxite in Italia: Rassegna min., v. 15, p. 17, 1901 [Italian].

**Oates, F.** *See* Teale, E. O.

**Catz, Paul.**

Mineral position of the ECA Nations; No. 6—The Netherlands: Eng. Min. Jour., v. 149, no. 12, p. 82–83, 1948.

In Dutch Guiana [Surinam], bauxite is being mined by the Surinam Bauxite Co. (affiliated with ALCOA) and the Billiton Co., Ltd., whose yearly productions are about 1,200,000 and 500,000 metric tons, respectively.

On Bintan Island, Indonesia, the Netherlands Indies Bauxite Mining Co. produces about 600,000 metric tons annually. Prior to the last war plants were being erected to manufacture aluminum and also to fabricate aluminum goods. Their status now is unknown.

**Center, Arthur A.**

Electrometallurgy: Eng. Min. Jour., v. 144, no. 2, p. 106–108, 151, 1943.

The main features of electrometallurgy for the year relate to the light metals. The section on aluminum gives increases or changes in production capacity in the United States during 1942. Use of the red mud residues from the Bayer process in a lime-soda-sinter process has been reported as desirable. In India workable deposits of bauxite were discovered in the Shevaroy Hills, 200 miles southwest of Madras. It is estimated that 100,000 long tons can be mined a year. Electric power is available in quantity. In Brazil, the C[ia] Brasileira de Aluminio plans to build a plant near São Paulo to produce aluminum from the Lindolpho Dias deposit nearby. The bauxite reserves are estimated to be about 5 million tons.

**Charrin, Victor.**

1. La bauxite et le "minium d'aluminium": Mines, carrières, 7[e] année, no. 64, p. 17–22M, 1928 [French].
2. Les bauxites en Russe: Mines, carrières, 9[e] année, no. 92, p. 65–68, 3 figs., 1930 [French].

Bauxite was discovered in the Tikhvin region, 221 kilometers from Petrograd, in 1916. Bauxite crops out in a north-south-trending line as a series of deposits along a definite geologic horizon, probably between the Devonian and lower Carboniferous. Three of the deposits are described in detail. Total tonnage for the whole region amounts to more than 4 million tons for the first four grades, with an additional 4 million tons of aluminous clays.

3. La bauxite en Catalogne [Spain]: Mines, carrières, 10[e] année, p. 17–19, Feb. 1931 [French].
4. La possibilité d'origine latérique des bauxites Françaises: Génie civil, tome 102, no. 12, p. 283–284, 1933 [French].
5. Découverte de la bauxite en Afrique occidentale française: Génie civil, tome 105, no. 6, p. 134, 1934 [French].

Bauxite was discovered in the French Sudan in the upper part of the Niger River valley. The deposits occur intermittently along a belt about 350 kilometers long, extending from Quenkoro west-southwest to Bassara. Chemical analyses are included of material from Kita, Koulouba, Bassara, and M'Pebougou; these show about 69–74 percent alumina, 1–4 percent silica, 1–5 percent iron oxide, and 20–27 percent water.

6. La bauxite en France: Chimie et industrie, tome 36, no. 5, Sources et débouches, p. 1054–1059, 3 figs., 1936 [French].

Four types of bauxite—white, red, gray, and refractory—are mined in France. The aluminum industry absorbs about 50 percent of the total output; chemical products, 15 percent; aluminous cements and refractories, 10 percent; abrasives, 5 percent; and miscellaneous, 5 percent. A reserve estimate of 60 million tons of bauxite, made some ten years earlier, is quoted but is considered only approximate.

7. Les bauxites de Riouw (Indes néerlandaises): Génie civil, tome 113, no. 26, p. 550, Paris, 1938 [French].

The bauxite deposits of the Riou Archipelago, Netherlands East Indies [Indonesia], are briefly described. These deposits are lateritic.

8. La bauxite verte des Pyrénées et la bauxite noire du bas Languedoc: Génie civil, tome 112, no. 14, p. 296, Paris, 1938 [French].

The source of the green color of a Middle Cretaceous bauxite deposit near Saint Paul-de-Fenouillet in the eastern Pyrenees, France, could not be determined. However, the color is not due to the presence of lime. The black color of a Jurassic deposit at Mireval in the lower Languedoc is due to the presence of organic matter.

9. Découverte de la bauxite à Pézenas (Hérault): Génie civil, tome 112, no. 7, p. 155–156, 1938 [French].

Bauxite was discovered in a hole drilled at Pézenas, Hérault, France, which encountered a deposit that is believed to be the westward extension of the Villeveyrac bauxite zone.

10. L'enrichissement des bauxites de qualité inférieure; les bauxites d'Aumelas (Hérault): Génie civil, tome 113, no. 4, p. 86–88, 2 figs. incl. geol. sketch map, Paris, 1938 [French].

Methods for improving the quality of low-grade bauxite are discussed. The bauxite deposits of the Aumelas region, Hérault, France, are described.

11. Les gisements de bauxite de l'Indochine: Génie civil, tome 115, no. 14, p. 272–273, sketch map, Paris, 1939 [French].

Bauxite deposits near Lang-Son, French Indo-China, occur in the zone of contact between highly metamorphosed limestone and rhyolite. They are unquestionably of lateritic origin.

12. Quelques considerations sur la bauxite: L'Argile, no. 193, p. 1–7, April 1939 [French].

The quality and size of the bauxite deposits of the world are briefly discussed, with a view to the position of French bauxite and its most effective utilization.

13. Les bauxites des garrignes de Hérault: Génie civil, tome 125, no. 16, p. 313–314, geol. sketch map, 1948 [French].

Bauxite occurs near Argeliers, Hérault, France, overlying Jurassic rocks as thin but rather extensive deposits. They are overlain by Tertiary sediments. The Saint-Paul-Valmal bauxite deposit is in Jurassic limestones.

**Chautard, Jean.**

1. (and Lemoine, Paul). Sur la genèse de certains minerais d'alumine et de fer. Decomposition latèritique: Acad. sci. Paris Comptes rendus, tome 146, p. 239–242, 1908 [French].

The chemical composition of the laterites of French Guinea is compared to that of the diabase which underlies them. These analyses showed an increase in alumina, iron, and titania, but a decrease in the amounts of lime, magnesia, sodium, and potassium.

2. (and Lemoine, Paul). Sur le phenoméne de latérisation: Soc. géol. France Bull., 4e ser., tome 8, p. 35–38, 1908 [French].

Laterites are defined as surficial weathering products of aluminum silicate rocks and, following the ideas of Max Bauer, as characterized by the presence of free aluminum hydrate. The steps in the process are: (1) the decomposition of iron and aluminum silicates; (2) the oxidation of the iron to form the sesquioxide; (3) the formation of free silica by the decomposition of various minerals; (4) the removal of most of the silica, alkalies. and alkaline earths; and (5) the accumulation of a residue rich in titania, alumina, and iron.

**Chermette, A.**

La bauxite dans la chaîne du Niandan-Banié (Haute-Guinée): Chronique mines coloniales, année 17, no. 161, p. 194–195, sketch map, Paris, 1949 [French].

**Chételat, E. de.**

Le modelé latéritique de l'ouest de la Guinée française: Rev. géographie phys. et géologie dynam., tome 11, fasc. 1, 120 p., 20 figs., 21 pls. incl. geol. map 1:1,000,000, 1938 [French].

Although much of tropical Africa is laterized, in western French Guinea between Fouta-Djallon and Portuguese Guinea, more than half of the area is covered by a thick lateritic mantle which in some places is concealed by sands and clays. The first part of the paper is a detailed description of the geology of the area; the second part is a discussion of the alteration and laterization of rocks and the role played by the lateritic cover in the formation of the topography.

**Chhibber, H. L.**

*1.* (and Misra, R. C., and Ranjan, P.) The bauxite deposit of the Bagru Plateau near Lohardage, Ranchi district, Bihar [India]: Indian Ceramic Soc. Trans. v. 1, no. 3, p. 177–202, 2 pls., 1942.

"The porphyritic granite-gneiss of the Bagru Plateau, Bihar, India, is the parent rock of the extensive bauxite deposit near Lohardaga. There were two stages in the formation of the bauxite: (1) formation of kaolin through the alteration of silicates by hydrothermal waters; (2) formation of bauxite by removal of two molecules of $SiO_2$ from kaolin. The bauxite deposit is overlain by primary ferruginous laterite which represents a third stage of development." *V. 10, 1943–44.

2. Origin of the bauxite deposits of India: Jour. Sci. Indus. Research, v. 5, no. 4. ser. B, p. 48–51, 1946.

In India there are four belts of bauxite deposits: (1) those in the Deccan Trap area overlying the basalt: (2) those capping the granite-gneiss plateaus in the Ranchi district, Bihar; (3) those overlying the Vindhyan limestone and sandstone rocks near Katni, Jubbulpore; and (4) those consisting largely of diaspore which are associated with the sub-Nummulitic clay-beds overlying Jurassic limestone in Jammu and in Poonch State. It is concluded that bauxite can be formed from any igneous, sedimentary, or metamorphic rock which is capable of developing residual clay, but that flat-topped, plateaulike elevations favor it. The steps postulated in the formation of bauxite and laterite are: (1) formation of kaolin by the hydration of feldspars and other silicates; (2) formation of bauxite by the desilication of clay; and (3) laterization of bauxite, in which process the cavernous texture is formed and iron, brought up from below, is precipitated near the top. The three stages are represented in the field by zones, the first being at the base.

3. Platinum in Dhangawan (Jubbulpore district, C. P.) bauxite: Jour. Sci. Indus. Research, v. 4, no. 7, p. 450, Delhi, 1946.

The Dhangawan bauxite quarry lies about a furlong before the 35th milestone on the Jubbulpore-Katni road. The deposit was opened in 1943 and at least part of the production was used in the manufacture of fire brick. In January 1944 production was about 8 tons a day. Platinum, gold, and copper were found to occur in small quantities in the bauxite.

4. Yellow clay associated with the bauxite of Padarwara (C. P.): Jour. Sci. Indus. Research, v. 4, no. 11, p. 718–719, 1946.

Northeast of the village of Padarwara, a section shows pisolitic bauxite blocks and single pisolites in the upper part of a yellow clay bed. The clay contains some feldspar fragments but no quartz; it is plastic and occasionally shows concentric banding that is considered to represent an initial stage in the formation of pisolites. The clay overlies the Vindhyan sandstone.

5. Platinum and silver in the bauxite of Tungar Hill, near Bassien, Bombay: Jour. Sci. Indus. Research, v. 6, no. 6, sec. B, p. 81–82, 1947.

Platinum extracted from a sample of bauxite and one of bauxite mud remaining after the preparation of aluminum sulfate amounts to: (1) Bauxite, 0.00006 percent or 9.4 grains (Troy) per long ton; (2) bauxite mud, 0.00013 percent or 20.4 grains (Troy) per long ton. The samples came from a flat-topped, steep-sided hill known as Tungar Hill northeast of Bassien, Bombay, where the bauxite is underlain by the Deccan Trap.

**Chinese Ministry of Information.**

China handbook, 1937–1943: MacMillan, 1943.

*Bauxite, p. 491.*—"Bauxite is mainly found in Liaoming and Shantung. It was recently discovered in Yunnan and Kansu. The Shantung reserves have a total of 271 million tons of bauxite which can give 68 million tons of aluminum. The Licioyang and Fahsian reserves in Liaoming have 110,000 tons of reserves with an aluminum content of 40 to 58 percent. The Yunnan reserves are still under study. The Kansu reserve is estimated at 351,350,000 tons of bauxite with an aluminum content of 22.57 to 38.52 percent."

**Claiborne, Hamilton C.**

Developments in German aluminum industries: U. S. Bur. Foreign and Domestic Trade Commerce Repts., no. 13, p. 817–818, March 26, 1928.

Until 1926 the German aluminum industry depended largely on imports of bauxite from France, but in 1927 a greater tonnage came from Hungary, not a prior competitor. In the same year Yugoslavia became an important source of bauxite. Although the ore is lower in grade than that from France, the price is lower also.

It is reported that bauxite deposits have been discovered in the Atlas Mountains, French Morocco. "As reported from Marakash, the deposits are situated in the Atlas Mountains, and it is estimated that from top layers alone 20 million tons of bauxite can be obtained. The mineral has a large alumina content, estimated at 70 percent, and numerous waterfalls in the vicinity can furnish cheap water power for the mining operations." [No more detailed information or sources on the Morocco deposits is included.]

**Clarke, E. de C.**

The bauxites of the Darling Range—Southwest Division: Western Australia, Geol. Survey Ann. Rept., 1918, p. 19–22, 1919.

The bauxite deposits in the Darling Range in Western Australia occur on the tops of the hills but not in the valleys. The bauxite is considered to be a laterite and resembles an "ironstained conglomerate." The deposit rarely exceeds 3 feet in thickness. Partial chemical analyses show 25–45 percent alumina soluble in acid, and about the same amounts of iron. The insoluble silica ranges from 4 to 30 percent.

**Clark, Lorin D.**

General features of the Springvale bauxite district; text *on* map Guide to pros-

pecting in the Springvale bauxite district, Georgia: U. S. Geol. Survey Strategic Minerals Inv. Prelim. Map, scale 1:63,360, April 7, 1943.

A large-scale map shows areas that are preferred, favorable, or possible as prospecting for bauxite deposits. Bauxite mines and outcrops are also shown. A brief text describes the stratigraphic units, and the size, attitude, and stratigraphic position of the bauxite deposits.

**Clarke, Frank Wigglesworth.**

The data of geochemistry: U. S. Geol. Survey Bull. 770, 841 p., 1924.

*Laterite and bauxite, p. 496–504.*—This is an excellent résumé of the contributions of many workers throughout the world to the study of the genesis of bauxites and laterites. The emphasis is on chemical reactions and mineralogy, not on geologic field relationships.

**Clemmer, J. B.**

(and Clemmons, B. H., and Stacey, R. H.) Preliminary report on the flotation of bauxite: U. S. Bur. Mines Rept. Inv. 3586, 26 p., 1941.

Tests were run to determine the feasibility of treating low-grade bauxite by froth flotation to obtain concentates of commercial grade. Differential grinding and desliming tests were also run. The results indicate that silica can be rather easily removed without much loss in the alumina content, but that removal of iron is more difficult by these methods.

**Clemmons, B. H.** *See* Clemmer, J. B.

**Coelho, Ifigĕnio Soares.** *See* Guimarães, Djalma.

**Coghill, Will H.**

Titanium in bauxite ores and sludges: U. S. Bur. Mines Rept. Inv. 2867, 4 p., 1928.

Heavy liquid concentrates of granular bauxite sludge were studied. Much of the titanium occurred disseminated in both bauxite and kaolinite mixtures in the sludge. Chemical analyses of the fractions and cuts are included.

**Cole, Grenville A. J.**

1. The rhyolites of the County Antrim with a note on bauxite: Royal Dublin Soc. Sci. Trans., ser. 2, v. 6, p. 105–109, 1896.
2. The laterite and bauxite zone of north-east Ireland: Geol. Mag. decade 5, v. 5, p. 471, 1908; Irish Naturalist, v. 27, p. 235, London, 1908.

The bauxite and laterite in the basalts of northeastern Ireland are considered to have been formed in place. The pale bauxites are considered to have been derived from rhyolite as is shown by the presence of bipyramidal crystals of quartz which occur in each.

3. (and Wilkinson, S. B., McHenry, A., Kilroe, J. R., Seymour, H. J., Moss C. E., and Haigh, W. D.) The interbasaltic rocks (iron-ores and bauxites) of northeast Ireland: Ireland Geol. Survey Mem., 129 p., 23 figs., 6 pls., 2 maps, 1912.

In County Antrim several thin and one relatively thick zone of red clay occur within a series of basalt flows. The material is high in iron and alumina and was first mined as an iron ore, but the enterprise was not an economic success. The typical succession downward is pisolitic iron ore, pavement, and lithomarge. On the basis of plant remains, this zone may be Eocene or Oligocene in age. These

beds occur at various horizons but primarily in a zone representing a prolonged quiet period between epochs of voclanic activity. The source of the beds may be the underlying volcancics but may also include material brought from some distance and deposited in lakes. In County Antrim, eruption of rhyolite occurred during a period of comparative quiet, and it is considered probable that the light-colored bauxites were derived from them. Numberous chemical analyses and maps accompany a description of each of the mines and prospects.

4. Memoir and map of localities of minerals of economic importance and metalliferous mines in Ireland: Ireland Geol. Survey Mem., Min. Res., p. 22–25, map, scale 1 in. to 1 mi., 1922.

*Bauxite, p. 22–25:* Production of bauxite in the United Kingdom was long limited to County Antrim and, sporadically, the County of Londonderry, Ireland. Important localities where bauxite has been mined are shown on the map. Production for several representative years is included. The high silica content of the bauxite has caused most of it to be used in the production of aluminum sulfate.

**Colin, L. L.**

Bauxite in the Mocambique Territory [Portuguese East Africa]: South African Min. Eng. Jour., v. 53, pt. 2, no. 2602, p. 329–332, 2 figs., 1942 [English].

The bauxite deposits of the Manica district, Portuguese East Africa, lie about 15 miles from Macequece at the top of Mount Moriangane. The elevation is about 6,000 feet and the summit difficult of access. The bauxite occurs at the contact of rocks of the Umtali "gold belt" and of acid intrusives—granites, gneisses, quartzite diorite, dolomites, and felsite. First quality white and red bauxite analyzes respectively as 66–74 per cent and 57–62 percent $Al_2O_3$, 6–10 and 3–5 percent $SiO_2$, 3–4 and 3–4 percent $TiO_2$, 2–4 and 18–26 percent $Fe_2O_3$, and 13–15 and 10–12 percent $H_2O$. The deposit has been worked since 1938 by the Wankie Colliery Ltd. The bauxite is considered probably due to subaerial weathering of the underlying syenite hornblende. The deposit contains an estimated 2.4 million tons of a mixture of bauxite nodules and clay; of this tonnage only 68,000 tons is of commercial grade at present. From other analyses included in the paper, the bauxite mineral appears to be gibbsite; the analyses of red and white bauxite noted above may represent partly calcined samples.

**Collier, James E.**

1. The aluminum industry of the Western Hemisphere: Econ. Geography, v. 20, no. 4, p. 229–257, 16 figs., 1944.

A comprehensive résumé of the location of bauxite districts and estimates of reserves in the western hemisphere. In the United States, bauxite occurs principally in Arkansas but also in Alabama, Georgia, Tennessee, and Virginia; reserves for the country are estimated at 18,241,000 tons on a mined and dried basis. In Surinam, the deposit at Moengo is estimated to contain about 10 million tons of ore; the deposits on the Suriname River at Rorak, 8 million; no reserve estimates have been made for the country as a whole. In British Guiana, 10 million tons of bauxite is estimated to occur along the Demerara and Berbice Rivers. More than 80 deposits of bauxite are known in Brazil, and reserves for the country have been estimated as high as 150 million tons. The largest known deposits occur on the Poços de Caldas plateau, and reserves for this section are estimated at 120 million tons. Little is known of the reported occurrence of bauxite in French Guiana, and little exploration has been done. In Venezuela, bauxite occurs along the Amacura River, and reserves have been estimated to be 10 million tons. Small scale maps show the location of deposits, and manufac-

turing facilities, and charts show reserves, production, consumption, and related information.

2. Aluminum Industry of Europe: Econ. Geography, v. 22, no. 2, p. 75–108, 13 figs., 1946.

The location of the bauxite districts of Europe together with reserve estimates is briefly discussed by countries. Small-scale maps are effectively used to show location of deposits, alumina and aluminum plants, reserves, the flow of trade between countries, etc. The location of manufacturing facilities, sources of hydroelectric power, and trade are evaluated with a view to future markets and production centers.

3. Aluminum resources of the United States: Econ. Geography, v. 24, no. 1, p. 74–77, 1948.

The bauxite reserves of Arkansas and Georgia and the location of principal districts are given briefly. General information on the location and size of deposits of alunite and high-alumina clays throughout the country is also included.

**Collot, L.**

Âge des bauxites du Sud-Est de la France: Soc. géol. France Bull. 3e sér., tome 15, p. 331–345, 4 figs., 1887 [French]; abs., Acad. sci., Paris, Comptes rendus, tome 104, p. 127–130, 1887; North of England Inst. Min. Engineers, v. 31, p. 4, 1888.

The bauxite deposits of southeastern France overlie rocks ranging in age from Infalias to Urgonian and are overlain by those ranging from Cenomanian to Danian. The deposits themselves, however, are considered to represent the Aptian and Gault intervals only.

**Conant, Louis Cowles.**

1. (and McCutcheon, Thomas Edwin). Tippah County mineral resources: Miss. Geol. Survey Bull. 42, 228 p., geol. map, 21 figs., 1941.

*Bauxite, p. 39–41, 63–64, 187, 202.*—A low-grade bauxite was found to crop out along a narrow ridge on the T. W. Meadows property and may underlie the entire ridge to a depth of 60 feet. Another small deposit caps a low hill 3 miles west of Blue Mountain. The bauxite-kaolin zone is considered to represent weathering of the Porters Creek clay during the Midway-Wilcox interval. It is suggested that the bauxite and kaolin deposits are remnants of formerly more extensive beds; and because of uplift and rejuvenation, the region was eroded, removing much of the original deposits. Such erosion is substantiated by buried topographic irregularities. Chemical analyses include the percentage of soluble and insoluble alumina. The deposits described in this bulletin are those discovered after the publication of Bulletin 19, by P. F. Morse, in 1923.

2. (and McCutcheon, Thomas Edwin). Union County mineral resources: Miss. Geol. Survey, Bull. 45, 158 p., geol. map, 14 figs., 1942.

*Bauxite, p. 43–44, 61.*—Most of the bauxite deposits of Union County lie directly on the Porters Creek clay from which they are considered to have been derived during the Midway-Wilcox interval. A few deposits, however, were eroded and redeposited at various distances stratigraphically higher in the Eocene sand. The deposits described in the bulletin are those discovered since the publication of Bulletin 19 by P. F. Morse in 1923.

**Connah, T. H.** *See* Shepherd, S. R. L.

**Cooper, W. G. G.**

1. The bauxite deposits of the Gold Coast: Gold Coast Geol. Survey Bull. 7, 34 p., 10 pls., 1936.

Bauxite was first discovered in the Gold Coast on Mount Ejuanema by Sir Albert Kitson. Most of the bauxite is found in the western part of the Colony and in Ashanti capping steeply dipping, folded, and sheared lavas, ash, and tuff of the Birrimian system or flat-bedded Voltaian shales. The major deposits are (a) the Mpesaso and Yenahin groups, Ashanti; (b) Affoh group, Sefwi Bekwai; (c) Nsisreso, Asempanaiye, NW. Sefwi; and (d) Ejuanema, Kwahu. The location is shown on index and large-scale maps. It is considered that "laterization took place on wide peneplained surfaces and that subsequent enrichment to form bauxite took place during the dissection of such peneplains." The geologic and bauxite deposits are described by areas; chemical analyses are included. A section on economic considerations is also included.

2. Gold Coast bauxite: Imp. Inst. Bull., v. 34, no. 3, p. 331–347, 1936.

Two large and several smaller groups of bauxite deposits occur in the Gold Coast—the most important are the Mount Ejuanema, Sefwi Bekwai, Yenahin, Mpesaso, and Asafo. Test pits were put down in these areas. Chemical analyses of the samples collected are included. The deposits are 20–60 feet thick and are a part of a lateritic capping on a dissected and uplifted peneplain surface cut on steeply-dipping phyllite, lavas, tuffs, and on flat-lying clay shales. The deposits now occupy the flat tops of hills at altitudes of 1,600–2,600 feet. It is considered that bauxitization took place during Tertiary time, probably due to the action of carbonated ground waters on the bedrock, and that the process has now ceased. A description of deposits and a section on economic considerations are included.

**Coquand, H.**

Sur les bauxites de la chaîne des Alpines (Bouches-du-Rhône) et leur âge géologique: Soc. géol. France Bull., 2e sér., tome 28, p. 98–115, 3 figs., 1871 [French]; abs., Neues Jahrbuch, p. 940–941, 1871; Jahresber. Chemie, p. 1144, 1871. [German].

The types of both aluminous and ferruginous bauxite in the Bouches-du-Rhône district, France, their geologic and geographic occurrence, and their origin are discussed. All these deposits are considered to have been formed during the *Lychnus* epoch, from the action of geysers.

**Corbet, A. Steven.**

Biological processes in tropical soils, with special reference to Malaysia: 156 p., 10 figs., 16 pls., Cambridge, W. Heffer and Sons, Ltd., 1935.

Concerning laterite, the author states that the oxides of both iron and alumina are more soluble in water containing $CO_2$ or organic matter than in pure water; but with silica or kaolin, the reverse is true. Because there is little of the carbonaceous constituents in water of tropical regions, the soils are leached of the silica and kaolin, resulting in the gradual accumulation of the oxides of iron and aluminum. This process is called laterization. Jenny first showed that the temperature and the humidity (precipitation/evaporation) determine the nitrogen content of soils. Because of the author's studies of the effects of sunlight on decomposition of organic matter, he suggests the following modification of Jenny's law: "The nitrogen and organic matter content of the soil decrease with increasing insolation and temperature, provided that the same conditions of humidity obtain." At temperatures below 25° C there can be an accumulation of organic matter, but above 25° C decomposition exceeds accumulation.

**Cornu, F.**

1. Die Bedeutung der Hydrogele im Mineralreich: Kolloid Zeitschr., Band 4, pp. 15–18, 1909 [German].

The crystalline and gel forms of minerals in the following groups are listed: the hydroxides, carbonates, uranates, phosphates, hydrous arsenates, hydrous antimonates, hydrous silicates, and organic gels. Of the hydroxides, the most important are bauxite and the iron minerals. Hydrargillite ($Al_2O_3 \cdot 3H_2O$) and diaspore ($Al_2O_3 \cdot H_2O$) are the crystalline forms of bauxite, and bauxite, or cliachite, is the gel form ($Al_2O_2 \cdot 2H_2O$). The gel form of the hydrous iron minerals, goethite and an unnamed mineral, is stilpnosiderite.

2. Über die Verbreitung gelartier Körper im Mineralreich, ihre chemisch-geologische Bedeutung und ihre systematische Stellung: Centralbl. Mineralogie, Jahrg. 1909, p. 324–336, 1909 [German].

In weathering, rocks are considered to change to either a crystalline or a colloidal state. The colloids, such as the hydrogels, molybdategel, and so forth, are discussed.

**Costa Sena, J. da.** *See* Sena, J. de Costa.

**Coulter, Don M.**

1. Bauxite deposits in Union and Pontotoc Counties, Miss.: U. S. Bur. Mines Rept. Inv. 4235, 8 p., 9 figs., 1948.

In the course of a drilling program in Union and Pontotoc Counties in 1943, 97 holes were put down; in 18 of these, bauxite or bauxitic clay were encountered. It was hoped that bauxite bodies higher in grade might be discovered down the dip from the Midway-Wilcox contact, but only 5 holes penetrated bauxite in such places, and only 12,000 tons of grade D bauxite was delimited. In all drilling in the area, 58,000 tons of bauxite and bauxitic clay was delimited. Chemical analyses of drill cores are included in the report. The system of ore grades is that used by Thoenen and Burchard in 1941.

2. Bauxite in Cherokee and Calhoun Counties, Ala.: U. S. Bur. Mines Rept. Inv. 4223, 28 p., 15 figs., 1948.

A drilling program was conducted in the Rock Run, Goshen Valley, and Nances Creek districts, Cherokee and Calhoun Counties, in 1942 and 1943. A total of 222 holes were drilled; of these, 88 penetrated bauxite but all deposits were too low in grade to be considered ore. Chemical analyses of drill cores and other samples taken are given in a table.

3. Margerum bauxite district, Colbert County, Ala.: U. S. Bur. Mines Rept. Inv. 4207, 10 p., 3 figs., 1948.

A drilling program was conducted in the Margerum bauxite district during 1943. Thirty-seven holes were put down with a power drill, and 35 were drilled with hand tools; of the first, Grade D or better bauxite was encountered in 11 holes, and of the second, similar material was encountered in 18 holes. The drilling showed that the bauxite occurs in small deposits, twelve of which were delimited. Reserves are estimated to be 12,000 tons of grade C bauxite, with an additional 175,000 tons of grade D material. Analyses of drill cores are included in a table. The classification of the ore as to grade is that used by Thoenen and Burchard in 1941.

**Craig, Lawrence Carey.** *See* King, P. B.

**Crema, Camillo.**

1. Osservazioni sui giacimenti di bauxite dell'Istria e della Dalmazia: R. accad. naz. Lincei Atti, Rend., ser. 5A, v. 29, pt. 1, p. 492–496, 1 fig., Rome, 1920 [Italian].

The bauxite deposits of Istria, Dalmatia, and the Apennines are very similar and occur as irregular lenses in limestone. In these areas they are a part of the Cretaceous series, which is equivalent to the Abruzzi facies. They occupy depressions and fractures in a karst surface developed between limestones of Cenomanian and Turonian ages. After deposition of the Cretaceous sediments, the area was uplifted in a post-Eocene diastrophism and eroded, thus exposing some of the bauxites to erosion. Subsequently Miocene limestones were deposited in parts of the area, unconformably overlying the Cretaceous and in some places resting directly on the bauxite. In areas where there is only an unconsolidated alluvial cover, the bauxite has been said to be Cenozoic in age, but the author finds no evidence to substantiate this hypothesis.

2. Le bauxiti dell'Istria e Dalmazia: Miniera Italiana, anno 4, p. 3–10, 4 figs. Rome, 1920 [Italian]; abs., Min. Jour., v. 132, p. 137, London, 1921. [English].

The bauxite deposits of the provinces of Dalmatia (Yugoslavia) and Istria (Italy) are of considerable commercial interest. Chemical analyses of the bauxite show 63–50 percent alumina, 0.9–9.3 percent silica, 14–28 percent iron oxide, 1.9–3.3 percent titania, and 13–27 percent loss on ignition. A section on production includes tonnages mined from 1915 to 1917 and gives the names of mining companies and the deposits owned by them. Prices and royalty fees are based on the percentage of alumina less twice the percentage of silica.

3. La bauxite in terra d'Otranto: Miniera Italiana, anno 12, no. 12, p. 426–427, 1928 [Italian].

Recent studies of the stratigraphic position of the bauxite deposits near Otranto, Italy, indicate that they may be Turonian in age. The present note is considered to be preliminary.

4. La bauxite nel promontorio del Gargano [Italy]: Miniera Italiana, anno 14, no. 2, p. 52–54, sketch map, 1930 [Italian].

Bauxite occurs in seven localities in the central part of the Gargano peninsula on the Adriatic coast of Italy. It is generally pisolitic, red in color, and high in iron.

5. Singolare utilizzazione di affioramenti bauxitici in Terra d'Otranto: Soc. geol. Italiana Boll., v. 49, p. 177–178, 1 fig., 1930 [Italian].

A cistern was constructed in bauxite in a limestone area in Puglia, Italy, because in contrast to the limestone, it was relatively impermeable and easy to excavate.

6. La bauxite in Puglia: Italy R. Ufficio geol. d'Italia Boll., v. 56, no. 3, p. 1–14, 2 maps, 1931 [Italian].

The many bauxite deposits in Puglia, Italy, are listed, and the locations are shown on maps. They are briefly described, and chemical analyses showing 49.49–55.75 percent alumina and 22.97–32.69 percent iron oxide are included.

7. Le Risorse in minerali d'alluminio della due sponde Adriatiche: Soc. Italiana prog. sci. Atti, 21$^{mo}$ riunione, v. 2, p. 120–144, 5 figs., 1934 [Italian].

The location, size, and quality of the bauxite deposits and the aluminum ore reserves of the area along the Adriatic coast, in Italy, are described in detail.

8. Nuove zone bauxitiche in terra d'Otranto: Miniera Italiana, v. 13, no. 5, p. 165–166, 1 fig., May 1939 [Italian].

The location of new bauxite deposits in Otranto, Italy, are shown on a map. Chemical analyses of 3 samples are included: the first is typical and is as follows: 4.63 percent silica, 52.29 percent alumina, 22.97 percent iron oxide, 3.07 percent titania, and 16.46 percent water.

**Crook, T.** *See also* Blake, G. S.

1. On the use of the term "laterite": Geol. Mag., decade 5, v. 6, no. 11, p. 524–526, 1909.
2. The use of the terms "laterite" and "bauxite": Geol. Mag., decade 5, v. 7, no. 5, p. 233–235, 1910.

These notes are part of a discussion, by correspondence, on nomenclature; *see also* J. B. Scrivnor and J. W. Evans.

**Cullen, Herbert L.**

Bauxite: U. S. Bur. Mines Minerals Yearbook, 1947, p. 172–182, 1949.

Statistics on domestic and world production and consumption include the current and previous years. The production and uses of domestic and imported ore are discussed. Bauxite mining in foreign countries is discussed, and data on size of deposits, new developments, or names of mining companies are included. Domestic production increased 9 percent over 1946: mines in Arkansas contributed 96 percent of the total; the remainder came from Alabama and Georgia. Imports increased 114 percent over 1946. The aluminum industry consumed 83 percent of all domestic and imported ore. Most of the remainder was used in the chemical, refractory, and abrasives industries.

**Dale, George K.** *See* Malamphy, Mark C.; Thoenen, John R.

**D'Achiardi, Giovanni.**

Analisi de alcuni minerali bauxitici italiani: Soc. toscana sci. nat. Atti, Processi-verbali, v. 13, p. 93–96, 1902–03 [Italian].

Methods of chemical analysis of bauxite and of other minerals included in it in minor quantities, especially those containing titanium, are briefly described.

**D'Ambrosi, Carlo.**

1. Nuove ricerche sull'origine delle "terre rosse" istriane: L'Istria agricola, 1939.
2. Sull'età' e sul significato geologico dei calcari brecciati di Orsera in Istria e della loro bauxiti: Soc. geol. Italiana Boll., v. 59, fasc. 1, p. 25–36, Rome, 1940. [Italian, Latin summary.]

The geologic significance of the bauxite deposits and associated limestone breccia near Orsera, in the Istrian peninsula, Italy, are discussed.

3. Sacche di bauxite deformàte da spinte orogenetiche presso Buie d'Istria: Soc. geol. Italiana Boll., v. 59, fasc. 3, p. 327–338, 3 figs., Rome, 1941 [Italian].

The author limits his discussion to the geologic significance of certain deformed bauxite deposits in the Istrian peninsula, Italy. The deposits are of Cenomanian age (Late Cretaceous) and evidently were deformed by a continuation into the Tertiary period of tectonics which produced the Buie anticline to the northeast during Cretaceous time.

**Dammer, Bruno.**

(and Tietze, Oskar). Bauxit, Section *in* Die nutzbaren Mineralien, Band 1: p. 279–298, 5 figs., Stuttgart, Verlag von Ferdinand Enke, 1927 [German].

This section is a résumé of the mineralogy of bauxite, and of the geologic and geographic occurrences of bauxite deposits of the world. Information on production and consumption is included.

**Damour, A. A.**

Note sur un hydrate d'alumine ferrugineuse trouvé dans l'Ile d'Egine (Grèce): Soc. géol. France Bull., tome 22, p. 413–416, 1864–1865 [French].

Chemical analyses of some pisolitic material from Agios Island, Greece, showed a composition analogous to the hydrate of alumina collected from Baux, France.

**D'Aoust, Virlet.**

1. De la formation des oolithes et des masses nodulaires en général: Soc. géol. France Bull., 2e sér., tome 15, p. 187–205, 1857–1858 [French].

This paper is a general discussion of the formation of calcareous and ferruginous oolites, but not bauxite.

2. Notes minéralogiques et géologiques sur le mineral de fer alumineux pisolithique de Mouriès, dit aussi de Baux, canton de Saint-Rémy, département des Bouches-du-Rhône: Soc. géol. France Bull., tome 22, p. 418–420, 1864–1865 (French).

The pisolitic iron-aluminum ore of Baux in the Département of Bouches-du-Rhône, France, contains 25–30 percent iron. This low content makes it a poor commercial source of iron ore, but from the point of view of the formation of pisolites, the deposit is of considerable scientific interest. The material is recognized to be a mixture of iron and aluminum hydrates—the white pisolites being largely aluminous, and the red, ferruginous.

**Daubrée, A.**

1. Note sur l'existence de gisements de bauxite dans le départements de l'Hérault et de l'Ariège: Soc. géol. France Bull. 2e sér., tome 26, p. 915–919, 1869 [French].

The location of deposits of bauxite in the Départements of Hérault and Ariège is noted, and the geology briefly described.

2. Note sur un silicate alumineaux hydraté, déposé par la source thermale de Saint-Honoré (Nièvre) depuis l'époque romaine,: Acad. sci., Paris, Comptes rendus, tome 83, p. 421, 1876 [French].

A silicate mineral similar to halloysite occurs in concretionary masses in warm water springs in the vicinity of Saint-Honoré, France. Chemical analyses indicate 76.6 percent silica, 12.6 percent alumina, 2.3 percent iron oxide, 1.8 percent lime, and 6.3 percent water.

**Davis, Hubert W.**, and **Trought, Mary E.**

Bauxite: U. S. Bur. Mines Minerals Yearbook, 1946, p. 174–186, 1 fig., 1948.

Statistics are presented on domestic and world production and consumption during the current and previous years. Subjects discussed are: the production and uses of domestic and imported bauxite; mining companies and the areas in which they operated; and bauxite mining in foreign countries. Data on size of deposits, new developments, or names of mining companies are included.

**Davis, L. H.** *See* Seelye, F. T.

**Deans, T.**

Coal, bauxite, and cement in Nyasaland: Imp. Inst. Bull., v. 43, no. 2, p. 124–127, London, 1945.

The bauxite deposits of the Mlanje Plateau, Nyasaland, had been under investigation by the Anglo American Corporation of South Africa, Ltd. since 1939; during 1943 the Nyasaland Geological Survey made a detailed examination of the deposits. Chemical analyses of 160 samples indicate that the silica content is high, but that most of it occurs as quartz which can be removed by washing. The average composition is 41.56 percent alumina, 18.30 percent silica, 1.29 percent combined silica, 14.02 percent iron oxide, 1.54 percent titania, and 22.87 percent water. Of the silica, 17.07 percent can be removed as quartz, leaving a product containing 50.59 percent alumina, 2.62 percent silica, 17.07 percent iron oxide, 1.87 percent titania, and 27.84 percent water.

**Delyannis, Ant. A.**

1. Der griechische Bauxit und seine Aufschliessbarkeit: Metall u. Erz, Jahrg. 34, Heft 11, p. 282–287, 1937 [German].

The large deposits of bauxite in Greece are very high in alumina and low in silica. The bauxite consists primarily of the mineral diaspore with minor amounts of boehmite. The difficulty in reducing these ores by the usual Bayer process is discussed.

2. (and Alexopoulos, Kesser) Kristalline Structur und Aufschliessbarkeit des griechischen Bauxits: Metall u. Erz, 34 Jahrg., p. 476–477, 1937 [German].

The method of X-ray analysis was adopted in distinguishing between boehmite-bearing and diaspore-bearing bauxites in Greece because the chemical composition of both is the same. Diaspore not only is not amenable to reduction in a Bayer plant, but it tends to use up the soda.

3. (and Alexopoulos, Kessar) Krystallstructure und Aufschliessbarkeit des griechischen Bauxits: Akad. Athénon Prakt., tome 12, no. 5–6, p. 373–376, 4 figs., 1937 [Greek, German summary].

X-ray analysis was used to determine the mineral composition of Greek bauxites, as chemical analyses only showed that the alumina occurred as a monohydrate—either boehmite or diaspore. A reliable method of distinguishing these minerals is of utmost importance in the commercial use of these bauxites, as boehmite can be used in the Bayer process for the production of aluminum, but diaspore cannot.

4. Ein neues Verfahren für die Bestimmung der Aufschliessbarkeit von Bauxit: Metall u. Erz, 37 Jahrg., p. 194–198, 3 figs., 1940 [German].

Thermal dehydration curves of pure samples of boehmite and diaspore and of Grecian bauxites are presented. Although both minerals lose their water at approximately the same temperature, the difference was found sufficient to estimate percentages of each in mixtures. In samples that are mixtures, there is only a single break in the curve, but the temperature at which this break occurs falls between those for the two pure samples, and is proportional to the percentage of each.

**Denisevich, A. A.**

The form and composition of bauxite ore-bodies of the North Urals: Akad. nauk SSSR Izv. Ser. geol., no. 5–6, p. 102–114, 1 fig., 1942 [Russian, English summary].

"The form of the bauxite ore-body of the North Urals deposits, the structure of its ore-strata and the hypergenic alteration of the chemical and mineralogical composition of ores are discussed." (English summary.)

**Dentz, F. (Oudschans)**

De Bauxietnijverheid en sichting van een nieuwe stad in Suriname: West-Indische Gids, 2 Jaarg., no. 10, p. 481, 1921 [Dutch].

**Déribéré, Maurice.**

Observations sur le pH de quelques bauxites: Soc. géol. France, Compte rendus, fasc. 15, p. 299–300, 1938 [French].

In distilled water, the pH of pisolites from French bauxite deposits ranged fror 6.0 to 7.9, and was higher for the redder samples. Few pisolites tested below 7.2 Pure aluminum hydroxide is neutral, therefore differences in pH must be due t the impurities. Iron causes variations toward alkalinity, therefore the higher th iron content, the higher the pH. The reason for a pH below 7 is not yet known

**Deutsche Chemische Gesellschaft.**

Gmelins Handbuch der anorganischen Chemie; System-Nr. 35—Aluminium 8e Auflage: Teil A, Lieferung 1–7, 1234 p., 403 figs.; Teil B, Lieferung 1–2 613 p., 43 figs., Berlin, Verlag Chemie, G. m. b. H., 1933–1941; Photo-Lithoprint reproduction, Edwards Brothers, Inc., Ann Arbor, Mich., 1943; Teil A, Lieferung 8, p. 1235–1370, illus., Berlin, 1950 [German].

These volumes constitute a compendium of information on the physical, optical, electrical, and chemical properties of aluminium and its compounds and the composition of aluminium-bearing minerals. The various chemical combinations and systems in which it may occur are discussed in separate sections in great detail. Deposits of bauxite, laterite, and diaspore are discussed rather briefly, by countries, on pages 83–99 of Teil A.

**Deville, Henri Sainte-Claire.**

Minerais alumineux ou bauxite, *in* De la presence du vanadium dans un mineral alumineux du midi de la France: Annales chimie et physique, tome 61, p. 309–326, 1861 [French].

This paper marks the first appearance in the literature of the now common spelling of "bauxite", although it is not mentioned as an innovation. Most of the paper is a discussion of methods of chemical analysis, and the quantity and form of vanadium in the rock samples.

**Dickinson, D. R.**

The nature and origin of Tasmanian bauxite: Imp. Inst. Bull., v. 41, no. 3, p. 200–203, London, 1943.

It is considered that bauxite in Tasmania "originated from the decomposition in situ of volcanic tuff accumulations", and was followed or accompanied by the deposition of overlying sands, clays, and lignite. In the Ouse district, there is an iron-rich zone close to the surface in most places, in which the bauxite has a pisolitic texture. A second iron-rich layer commonly occurs at the base of the bauxite. The higher-grade central part of the deposit, like the uppermost part, is also pisolitic and is, in general, lens-shaped. In places the bauxite occurs in depressions, and much of it appears to be water-laid. These deposits are overlain by the Newer Basalt series. At Campbelltown, however, the deposits do not show sorting and are generally flat-lying or have low dips. The high-grade, pisolitic ore is in the upper part and grades down into a mottled, friable material which may contain more iron than alumina. These deposits occur on a series of flat-topped ridges.

**Dieulafait, L.**

Les bauxites, leur ages, leur origine. Diffusion complète du titane et du vanadium dans les roches de la formation primordiale: Acad. sci. Paris, Comptes rendus, tome 93, p. 804–807, 1881 [French].

In France, deposits of iron and aluminum hydroxide occur throughout the Cretaceous strata; but five horizons are marked by much more extensive and thicker accumulations of bauxite. This paper is the first to suggest that these deposits were derived from the weathering of igneous rocks, instead of from clays residual from limestone. The following steps in the process are outlined: igneous and metamorphic rocks, especially granite, are disintegrated and decomposed by the action of water and other agents. The quartz and undecomposed feldspar form a sand, which rests on the bottom of the sea (Cretaceous); but the aluminous and ferruginous material, resulting from the decomposition of feldspar, is held in suspension and is then transported and deposited some distance away, according to the amount of wave action. These accumulations, consisting of the hydrate of aluminum with more or less admixed sesquioxide of iron, are called bauxite.

The vanadium and titanium in these bauxites are likewise considered to have been derived from granite, and are proportional to that present in the original rock.

**Dittler, Emil.** *See also* Doelter, C.

1. (and Doelter, C.) Die Anwendung der Kolloidchemie auf Mineralogie und Geologie; Bauxite ein naturliches Tonerdehydrogel: Kolloid Zeitschr., Band 9, Heft 6, p. 282–290, 1911 [German].

Samples of bauxite from Austria, Hungary, Yugoslavia, and France were studied in the laboratory. Comparisons and similarities in chemical composition, mineralogy, and physical properties are shown.

2. (and Doelter, C.) Zur Characteristik des Bauxits: Centralbl. Mineralogie, Jahrg. 1912, p. 19–22, 1912 [German].

The views of a great many authors are cited to show the wide divergence in definition of the term bauxite. The prevalent concepts are: (1) the original one, of a mixture—hydrargillite, diaspore, kaolin, and limonite; and (2) the mineralogic one, of an aluminum hydroxide colloid.

3. (and Doelter, C.) Zur Nomenklatur der Tonerdehydrate: Centralbl. Mineralogie, 1912, p. 104–106, 1912 [German].

In an attempt to clarify the nomenclature of materials containing one of the hydrates of alumina, the following terms were suggested: diaspore, for the known monohydrate; hydrargillite (gibbsite), for the trihydrate; and bauxite, for amorphous aluminum hydrate. In nature each of these occurs admixed with varying amounts of limonite, hematite, and kaolin. The terms diasporite, gibbsitite, and bauxitite are suggested for these mixtures.

4. Die Bauxitlagerstätte von Gánt in Westungarn: Berg- u. hüttenm. Jahr., Band 78, p. 45–51, 1 fig. and geol. map, Leoben, 1930 [German].

The bauxite deposits in the vicinity of Gánt, Hungary, occur as nearly flat-lying beds 8–10 meters thick. They overlie the upper Triassic Hauptdolomit and are in part overlain by Tertiary sediments. The bauxite itself is Paleocene or early Eocene in age. X-ray studies indicate that the alumina occurs as the monohydrate, boehmite. Yellow bauxite contains about 65 percent alumina, 21 percent iron oxide, 1 percent silica, and 9 percent loss on ignition. The underlying dolomite contains only 0.64 percent alumina, 0.14 percent iron oxide, and 0.12 percent silica. The question of the genesis of the bauxite is left open.

5. Bemerkungen zu einem von H. Harrassowitz erstätteten Referat über die Arbeit von E. Dittler, "Die Bauxitlagerstätte von Gánt in Westungarn": Centralbl. Mineralogie 1931, Abt. A, p. 125–127, 1931 [German].

This short paper is a reply to a review by Harrassowitz of the author's paper on bauxite in the vicinity of Gánt, Hungary (Berg- und Hütten. Jahrb., Band

78, p. 45–51, 1930). Harrassowitz' paper appeared in Neues Jahr., Ref. II, p. 737, 1930.

6. (and Kühn, Othmar.) Über die Genesis der Bauxite des oberen Sanntales: Akad. Wiss. Wien Anz., Band 68, p. 155–157, 1931 [German].

This is a preliminary note on the paper presented by the authors in 1933 (Chemie der Erde, Band 8).

7. (and Kühn, Othmar.) Die Genesis der Sanntaler Bauxite (Jugoslavien): Chemie der Erde, Band 8, Heft 3, p. 462–495, 8 figs., 1 pl., 1933 [German].

The andesite and associated bauxite in Triassic limestone in the Sanntal or Steiner Alps are not of the same age as the overlying pre-Oligocene eruptives along the "Schönsteiner line" but are, instead, infolded and overthrust remnants of formerly widely distributed effusive andesites. Most of the andesites have been altered to pyritic pyrophyllitic material, but all intermediate stages from andesite through highly siliceous products to the bauxite can be seen and were analyzed. The invariable occurrence of the bauxite with sialitic weathering products shows the connection between pyrophyllitization and its continuation into allitic weathering. Analyses indicate a general impoverishment in alkaline earths, alkalies, and silica from andesite to bauxite, although some sulfur, probably present as pyrite, remains. The sesquioxides and titania increase four- or five-fold, while the silica diminishes to about one-third. The allitic weathering was aided by the proximity of the Triassic limestones which furnished lime-bearing solutions and which are much silicified adjacent to the smaller deposits. In these smaller deposits also, slaty cleavage, due to movement along faults, is more pronounced, but the larger deposits are almost unchanged. The formation of bauxite occurred during a climatic cycle during which the pyrophyllitized andesite was altered but the much younger (Miocene) andesite remained unchanged.

8. Die Genesis der Sanntaler Bauxite [abst.]: Mineralog. petrog. Mitt., Band 45, Heft 5–6, p. 457–458, 1934 [German].

The genesis of the bauxite deposits of the Sanntal Alps, Yugoslavia, is briefly discussed. (See Dittler and Kühn, 1933.)

9. (and Kühn, Othmar.) Über den Bauxit von Dreistätten in Niederösterreich: Austria, Geol. Bundesanst. Verh., no. 12, p. 233–237, 1936 [German].

The bauxite deposits of Dreistätten (Lower Austria) are probably weathering products of the Middle Cretaceous or Turonian period of emergence. Chemical analyses of the bauxite and the underlying rocks are included. The bauxite is red-brown, pisolitic, and analyzes 16.50 percent silica, 43.66 percent alumina, 21.04 percent iron oxide, and 12.06 percent water. The high iron content is taken to indicate, not a true bauxite (as this term is generally used here for an aluminous material in limestone), but a lateritic weathering product of a basic rock. The nickel oxide content of the ore, 0.15 percent, indicates a gabbro or serpentine as the parent rock.

Dixey, F.

1. Notes on laterisation in Sierra Leone: Geol. Mag., new ser., decade 6, v. 7, p. 211–220, 1 pl., London, 1920.

In Sierra Leone a variety of rocks, including norite, granitic rocks, and detrital deposits, have been laterized. Norite forms gibbsitic laterite and is deeply weathered only in areas in which the rocks are highly jointed. The granitic rocks are laterized to a depth of 15–30 feet; these rocks decompose into white kaolinitic clay, which upward becomes a brown lateritic clay, and at the surface

a lateritic crust. Laterization of detrital deposits is more pronounced in feldspathic sands than in clayey beds.

2. The mineral resources of Nyasaland: Nyasaland, Geol. Survey Bull. 1, 8 p. [1922(?)–1923].

This paper on the mineral resources of Nyasaland contains only a brief reference to aluminous material. Bauxite was "observed in the Limbe area and on Zomba Plateau, and it may be * * * that similar deposits exist in other parts of the country also."

3. Deposit of bauxite at Mlanje: Nyasaland, Geol. Survey Dept. Ann. Rept., 1924, p. 6, [1924].

High-grade bauxite was found on the Luchenya Plateau. Two samples analyzed contained 1.21 and 1.70 percent silica, 62.08 and 59.80 percent alumina, 4.0 and 7.0 percent iron oxide, and 31.53 and 30.18 percent water. The deposit underlies a grassy upland and appears to have a large areal extent.

4. Bauxite deposits in Nyasaland: Min. Mag., v. 33, p. 201–205, 4 figs. (incl. sketch maps), London, 1925.

Bauxite occurs on the Lichenya Plateau in the Mlanje Mountains, Nyasaland. Deposits have also been discovered on the Likabula (Chambe), Sombani, and Little Rue Plateaus, in the Sombani and lower Rue Valleys, and on Manene Peak. All but the Lichenya and Chambe Plateaus are too isolated or too small to be worked. The Lichenya Plateau, 6,000 feet in altitude, is a rolling grassy upland, 2 miles long and 1 mile wide, at the head of the Lichenya River. The deposit is 15–30 feet thick over much of the area, but in some places the underlying rock comes to the surface. Using a mean thickness of 7 feet, there are estimated to be 20 million tons of bauxite in the area. The overburden is very thin. Chemical analysis of one sample approximates 60 percent alumina, 7 percent iron oxide, 1.7 percent silica, and 31 percent water. Accessibility of the deposits, transportation, water power, and labor are briefly discussed.

5. The bauxite deposits of the Mlanje Mountains: Nyasaland, Geol. Survey Dept. Ann. Rept. 1925, p. 4, [1925].

The bauxite deposits on the Lichenya Plateau in the Mlanje Mountains, Nyasaland, were partly explored by putting down eight shafts, to a maximum depth of 41 feet, and driving 11 adits. The deposit was found to be 15–30 feet thick over much of the two-mile square plateau, and in some places is more than 40 feet thick. If the average thickness is taken to be 7 feet, the deposit is estimated to contain 20 million tons of bauxite. Analysis of a sample taken at a depth of 6 feet in a shaft shows: 57.63 percent alumina, 10.35 percent iron oxide, 1.7 percent silica, and 29.92 percent water.

6. The bauxite of Zomba Plateau: Nyasaland, Geol. Survey Dept. Ann. Rept., 1927, p. 4–5, [1927].

In the concretionary bauxite deposits on the Zomba Plateau, Nyasaland, 12 test pits were put down to depths of 6–10 feet. Although pisolitic, hard material resembling rubble was found at the surface and at depth, chemical analyses showed only about 33–35 percent alumina and 44–26 percent silica.

**Doelter, C.** *See also* Dittler, Emil.

(and Dittler, E.) Bauxit oder Sporogelit: Centralbl. Mineralogie, Jahrg. 1913, p. 193–194, 1913 [German].

The term sporogelite was suggested as a mineral name by Kišpatić and Tucan for colloidal alumina combined with one molecule of water. However, because of the difficulties inherent in that system, the following classification is suggested:

the term bauxite is defined as colloidal $Al_2O_3.H_2O$; the rock term bauxitite is then restricted to rocks consisting largely of the colloid, bauxite. The terms diasporite and gibbsitite are likewise suggested for rocks consisting predominantly of diaspore and gibbsite, respectively.

**Dolbear, Samuel H.**

1. Industrial minerals: Eng. Min. Jour., v. 142, no. 2, p. 91–93, 1941.

This general paper includes a brief resumé of world production and consumption of bauxite.

2. Industrial minerals: Eng. Min. Jour., v. 143, no. 2, p. 90–92, 1942.

The paper includes a brief résumé of world production and consumption of all the industrial minerals. Production of bauxite in Surinam increased from 586,000 tons in 1940 to 1,200,000 tons in 1941. At least half the increase was from new fields. Production in the Netherlands Indies and Malaya was discontinued in 1941.

Flotation methods for reducing the amount of impurities in bauxite have been successfully used in the laboratory.

**Doll, E.**

Über einige Pseudomorphosen aus Brasilien: Austria, K. k. geol. Reichsanst. Verh., Jahrg. 1900, p. 148–150, 1900 [German].

Pseudomorphs of limonite after hydrargillite from Villa Rica, Brazil, are described together with several other pairs of pseudomorphs.

**Dorlodot, L. de.**

1. Présentation d'un échantillon de bauxite pisolithique: Soc. géol. Belgique Annales, tome 46, année 1922–1923, p. 35–36, 1924 [French].

A brief note on the types of bauxite in parts of French West Africa.

2. Au sujet des bauxites de l'Uele: Soc. géol. Belgique Annales, tome 51, Congo Belge année 1927–1928, p. 115–116, 1929 [French].

Chemical analyses of pisolitic bauxite from the Edi Valley, Belgian Congo, show 12.97 percent water, 33.58 percent silica, 52.09 percent alumina, 0.17 percent ferric oxide, and 0.58 percent titania. These analyses are considered to indicate an intimate mixture of alumina and silica hydrates.

**Dorsh, John B.** *See* Bridge, J.

**Douglas, E. A.**

Bauxiet en zijne toepassinger: Mijningenieur, p. 18–35, 1921 [Dutch].

A general account of the occurrence and utilization of bauxite in the world.

**Dovalina, José.**

1. La bauxita: México, Univ. Nac., Inst. Geología Anales, tomo 4, p. 1–5, 1930 [Spanish].

A general discussion of uses of bauxite, its chemical and mineralogic composition, and the principal countries in which it has been exploited. Production figures are given for several years prior to and including 1921, most completely for the United States.

2. Yacimientos de bauxita, cuya existencia pareció haber sido descubierta en Camargo (antes Santa Rosalia), Estado de Chihuahua: México, Univ. Nac., Inst. Geología Anales, tomo 4, p. 9–16, 1930 [Spanish].

Reported occurrences of bauxite near Camargo, Chihuahua, Mexico, were studied. The material is shown to be a clay in which the alumina varies between 12.78 percent and 23.83 percent, and the silica between 20.90 and 59.15 percent.

**Doyne, H. C.** *See* Martin, F. J.

**Drechsler, E.**

Analyse des Bauxits aus der Wochein: Dinglers polytech. Jour., 203 Band., p. 479–481, 1872 [German].

**Du Bois, G. C.**

Beitrag zur Kenntnis der Surinamischen Laterit: Mineralog. petrog. Mitt., Ser. 2, p. 1–61, 1903 [German].

**Dufrénoy, O. P. A. P.**

Traité de mineralogie: 1ère ed., tome 2, p. 347, tome 3 (Index), p. 799, Paris, Carilian-Goeury & Victor Dalmont, 1845–47; 2e éd., tome 2, p. 467, Paris, Victor Dalmont, 1856 [French].

The term "beauxite" is used to refer to the material described by Berthier from the vicinity of Beaux, France, but it is considered a mixture and not a distinct mineral species.

**Dunn, Robert.**

Discovery of bauxite in British Columbia: Canadian Min. Jour., v. 44, no. 48, p. 947–948, 1923.

Low-grade bauxite deposits were found near Stony and Demanial Creeks, Sooke district, Vancouver Island. The material is sold for use in refining gas. An analysis of a sample from Stony Creek shows 12.3 percent $H_2O$, 25.0 percent insoluble, 29.5 percent $Al_2O_3$; 30.5 percent $Fe_2O_3$, and 0.4 percent CaO.

**Dunstan, Wyndham R.**

Report on laterites from the Central Provinces [India]: India Geol. Survey Rec., v. 37, p. 213–220, 1909.

A number of samples of laterite collected in the Central Provinces, India, are described; chemical analyses are included. Although the material is high-grade bauxite, high cost of rail and water transportation to markets would eliminate the profit.

**Duparc, L.**

1. Les roches vertes et les filons de quartz aurifère du callao au Venezuela: Schweizerische mineralog. petrog. Mitt., Band 2, p. 1–68, 1 pl., 11 figs., 1922 [French].

The subaerial weathering products briefly described are cascajo, moco de hierro, and greda. These terms refer to concretionary masses and crusts consisting predominantly of iron oxides; no chemical analyses are included. The paper is largely a study of igneous and metamorphic rocks and the relations of the auriferous quartz veins.

2. Sur les gisements de bauxite des environs de Bédarieux. Schweizerische mineralog. petrog. Mitt., Band 11, Heft 2, p. 418–419, 1931; Soc. Helvétique sci. nat. Actes 112, p. 316–317, 1931 [French].

The abstract of an oral paper constitutes a short description of the bauxite deposits of Carlencas and Villeveyrac, France. The Carlencas deposits are 6 kilometers east of Bédarieux and occur in a pocket in dolomitic and siliceous lime-

stone of Bajocian (Middle Jurassic) age. The deposit is about 800 meters long by 10 meters wide, elongate in an east-west direction, and may represent an old filled fissure. Most of the bauxite is red and ferruginous but not at all homogeneous; the portion low in silica is used in the manufacture of aluminum, but that high in silica is used for cement. The deposits at Villeveyrac are about 50 kilometers east of Carlencas and occupy the edge of a shallow syncline. They are underlain by Upper Jurassic limestones and overlain by Cretaceous rocks of Maestrichtian age. The bauxite is 2–8 meters thick and is red and compact, white, nodular, and oolitic.

**Dvorshchan, Ye. I.** *See* Volkov, A. N.

**Edwards, A. B.**

The chemical composition of leucoxene in Cainozoic bauxite from Boolarra, Victoria: Mineralog. Mag., v. 26, no. 179, p. 273–274, 1942.

Some specimens of bauxite from Boolarra, Victoria, Australia, contained numerous grains of yellow-brown to amber-yellow leucoxene. The leucoxene is pseudomorphic after ilmenite, many containing a core of unaltered ilmenite. The bauxite is largely derived from Tertiary olivine basalt. Chemical analyses of the leucoxene showed 86.6 percent titania, 3.6 percent iron oxide, 1.2 percent silica, 0.5 percent alumina, and 8.0 percent water. Leucoxene therefore consists of hydrated titanium oxide. The iron in the analyses represents the residual cores of ilmenite; and the silica and alumina, the associated feldspar that could not be removed in sampling.

**Edwards, M. G.**

The occurrence of aluminum hydrates in clays: Econ. Geology, v. 9, no. 2, p. 112–121, 2 figs., 1914.

Published chemical analyses of 2,310 samples of clays of the United States were examined. Free and combined silica been differentiated in 244 analyses, in 180 of which rational analysis to kaolinite showed an excess of alumina. There was also an excess of alumina in 72 of the analyses in which there was no differentiation of silica. The author concludes that there is "nothing inherent in the conditions of weathering which admits of the possibility of the formation of aluminum hydrates only in tropical countries."

**Elizalde, Luis Ma. de.** *See* Powers, W. L.

**Ellis, Miller, W.** *See* Gordon, Mackenzie, Jr.

**Emelianoff, Georges.**

Sur les bauxites de la Lika (Yugoslavie): Acad. sci. Paris Comptes rendus, tome 201, no. 26, p. 1405–1407, 1935 [French].

The bauxite deposits of Lika, Yugoslavia, unlike those of Dalmatia and Herzegovina, are largely of diaspore. The age of these is considered to be pre-Lias, and they are the oldest bauxite deposits in the Balkans.

**Emory, Lloyd T.**

1. British Guiana: Eng. Min. Jour., v. 111, p. 363, 1921.

The Demerara Bauxite Co., Ltd., organized in 1916, by 1921 had erected a crushing and drying plant, built ore docks and the town of Mackenzie, and laid 10 miles of narrow-gauge railway from Mackenzie to its Three Friends mine. The company has a virtual monopoly of the industry in the country as all remaining Crown Lands have been withdrawn and there is little promising private land left.

2. Prospecting for bauxite in Dutch Guiana: Eng. Min. Jour.-Press, v. 118, no. 2, p. 45–48, 7 figs., 1924.

Mining methods, the country, its people, and modes of travel are described in a nontechnical account of a trip to the bauxite-producing areas in Dutch Guiana.

3. Bauxite deposits of British Guiana: Eng. Min. Jour.-Press, v. 119, no. 17, p. 686–689, 7 figs., 1925.

A review of the discovery of bauxite in British Guiana and of the formation of the Demerara Bauxite Co., Ltd. Mining methods and development of the deposits are also described.

4. Bauxite, its supply and manner of formation: Eng. Min. Jour., 123, no. 19, p. 771, 1927.

Tropical climates are considered to be probably necessary for the formation of bauxite, but there are several explanations why feldspar in temperate climates weathers to kaolin and, in tropical climates under favorable conditions, to bauxite. Pipes or fingers of bauxite in the underlying clay occur in several areas and may represent enrichment from above by leaching. Although bauxite occurs in many places, it is pointed out that only those deposits are of value from which the ore may be mined and shipped at a reasonable rate.

5. Bauxite deposits of British Guiana: Mining and Metallurgy, v. 9, p. 8–11, 4 figs., Jan. 1928.

Geographically, British Guiana consists of three belts—the coastal plain; the sand-clay, or foothill, belt; and the rolling tablelands of the hinterland. These areas are briefly described. The bauxite deposits are classified as: (1) derived from weathered pegmatite dikes; (2) lenses in the sand-clay belt between Christianburg and Akyma; and (3) lateritic deposits covering large areas near the juncture of the hinterland and the sand-clay belt. Of these classes, the first is too small to be of economic importance, and the third is too low in grade. The second, however, is being mined. These deposits are rather uniformly about 16 feet thick. They are underlain by clay in which are many small pipes and small masses of bauxite. In the sand-clay belt, these deposits crop out along the Demerara, Berbice, Ituni, and Mambakka rivers.

**Erhart, Henri.**

Les latérites du moyen Niger et leur signification paléoclimatique: Acad. sci. Paris Comptes rendus, tome 217, no.14, p. 323–325, 1943 [French].

Laterites of the central Niger River region in the French Sudan, French West Africa, are of paleoclimatological significance. The author does not believe that the laterite formed or is forming in place because (1) it shows neither pedologic horizons nor a transition zone to an underlying parent rock; and (2) the localities are in areas now partly desert. He concludes that the laterites result from alteration of aluminum silcate igneous rocks in a tropical rain forest in this area formed in Tertiary, Cretaceous, or earlier time. The forest disappeared as the climate became more arid, and the soil mantle was eroded, transported, and deposited as laterite, of which the present deposits are the remnants. Such a change in climate could happen concurrently in both France and Africa. Microscopic examination showed the laterites to be a mixture of kaolinite, gibbsite, iron hydroxides, and very minor amounts of boehmite. Very thin strings of colloidal silica were also seen. A ferruginous capping in some areas is a later development due to capillary rise of water.

**Esztó, P.**

Der Erzbergbau in Ungarny (Metal mining in Hungary): Magyar kir. József Nádor müszaki és gazdaságtudományi egyetem, A bánya- és kohómérnöki osztály Kozleményei, v. 10, pt. 3, p. 347–358, Sopron, 1938 [German; French and English summaries.]

A history of metal mining in Hungary from the prehistoric mining of gold and copper to the present mining of iron, copper, manganese, and bauxite. Each of these operations is described briefly.

**Evans, John W.**

1. The meaning of the term "laterite": Geol. Mag., decade 5, v. 7, no. 4, p. 189–190; 1910.
2. The term "laterite": Geol. Mag., decade 5, v. 7, no. 8, p. 381–382, 1910.

These notes are part of a controversy on nomenclature. [*See also* J. B. Scrivnor and T. Crook.]

**Ewing, F. J.**

The crystal structure of diaspore: Jour. Chem. Physics, v. 3, p. 203–205, 2 figs., 1935.

The parameters of diaspore were redetermined. The interatomic distances establish the existence and location of the hydrogen bonds. The diaspore and the analogous goethite structures are aluminum- or iron-centered octahedra. The formula for diaspore is written $AlHO_2$, but $HAlO_2$ is also correct in representing hydrogen-bonded oxygens. The usual formulas are considered incorrect in indicating the existence of water molecules or of OH ions.

**Fabre, G.**

Notes sur les failles et fentes à bauxite, dans les environs de Mende: Soc. géol. France Bull., tome 27, p. 518–520, 1869–1870 [French].

Bauxite deposits, considered as Tertiary in age, occur in faults in Jurassic rocks near Mende, France.

**Fahrenwald, A. W.**

Aluminum, alumina, bauxite, and clay: Idaho Bur. Mines and Geology Inf. Leaflet 17, 7 p., no date.

This general résumé includes short sections on alumina- and aluminum-producing companies and the location of plants, commercial sources of alumina, the Bayer and other processes, and clays.

**Faura i Sans, M.**

(and Bataller Calatayud, José R.). Les bauxites Triasiques de la Catalogne: Soc. géol. France Bull., sér. 4, tome 20, p. 251–267, geol. map, 1921 [French].

The stratigraphy from Paleozoic to Quaternary in Catalonia, Spain, is discussed, and a geologic map of the area, showing bauxite deposits, is included. The seven principal deposits are described in detail.

**Faust, George T.** *See* Alexander, L. T.

**Fedorov, B. M.**

1. O mezozoyskikh boksitakh vostochnogo sklona Srednego Urala (Über die mesozoischen Bauxite des Ostabhangs des Mittel-Urals): Moskov. obshch

ispytateley prirody, Nov. ser. tom 43, Otdel. geol. Byull., tom 13 (1), p. 42–70, 4 figs., 1936 [Russian, German summary].

The bauxite beds of Cretaceous age along the eastern slope of the Ural Mountains, U.S.S.R., are considered to be lacustrine deposits. The origin, stratigraphic position, and extent of the deposits are discussed.

2. Boksity bliz Nizhneserginskogo zavoda na Urale (The Nizhne-Serghinsky bauxite deposit), *in* Boksity, tom 2—Mestorozhdeniya boksitov, priurochennyye k paleozoyskim otlozheniyam (Bauxite, v. 2—Bauxite deposits confined to the Paleozoic): Vses. nauch.-issledov. inst. mineral'nogo syr'ya Trudy, vyp. 112, p. 51–69, 7 figs., Moscow-Leningrad, 1936 [Russian, English summary].

Bauxite occurs here in bands or lenses and "represents bauxite vein fillings" in limestone of Late Silurian or Early Devonian age. This vein filling probably took place simultaneously with the deposition of bauxite or soon thereafter. Bauxite bodies are cut by fractures that date from the Variscan folding. The mineralogical composition is largely diaspore, chamosite, calcite, dolomite, hematite, limonite, pyrite, quartz, rutile, and phosphates. Microscopic investigation indicated replacement of calcite by bauxite; one can distinguish bauxitic limestone, calcareous bauxite, and bauxite in which calcite is present in bands and as a fine powder. Much organic matter is present in this deposit making it very dark in color. Under the microscope the pea-shaped corpuscules are seen to consist of 3 or 4 tabular crystals of diaspore. The deposit is Late Silurian or Early Devonian in age. It is too small to be of economic interest.

3. Ovozmozhnosti nakhozhdeniya boksitov na Severnom Kavkaze [On the possibility of discovering bauxites in the Northern Caucasus]: Razvedka nedr, no. 17, p. 23–25, Moscow, 1937 [Russian].

The author discusses the possibilities of discovering bauxite in the northern Caucasus region, U.S.S.R., and the stratigraphic relations of continental sediments of Jurassic age to such deposits.

4. Usloviya zaleganiya i genezis mezozoyskikh boksitov Srednego Urala (Mode of occurrence and origin of the Mesozoic bauxites of the Middle Ural), *in* Boksity, tom 1—Mestorozhdeniya boksitov, priurochennye k mezozoyskim otlozheniyam (Bauxites v. 1—Bauxite deposits confined to the Mesozoic): Vses. nauch.-issledov. inst. mineral'nogo syr'ya Trudy, vyp. 110, p. 11–74, and 163–164, 16 figs., 2 pls. (photomicrographs), Moscow-Leningrad, 1937 [Russian, English summary].

The Mesozoic bauxite deposits of the Middle Ural lie in a narrow, discontinuous belt along the eastern slopes of the mountains. They occur as small bodies in continental sediments, overlain and underlain by rocks of Lower Cretaceous age. The mineral composition is largely gibbsite, ferric oxide (turgite?), hydrates of titania, chamosite (sometimes as much as 10 percent), siderite (as much as 30 percent), aluminum phosphates, and pyrite. It is suggested that the bauxite deposits represent chemical precipitation in lakes; the alumina and iron so precipitated were derived from the weathering crust which was widely developed in the Urals.

**Feigl, Fritz.**

(and Braile, Nicolau, and Miranda, Luiz Ignacio). A solubilização da bauxita fosforosa do Maranhão, Brasil: Cong. Panam. Engenharia Minas e Geología Anais 2° Cong., v. 2, p. 141–162, Rio de Janeiro, 1946 [Portuguese].

In an effort to find an economical method for recovering both alumina and phosphate from the high-phosphate bauxites of Maranhão, Brazil, preliminary

studies were made on the solubility of $P_2O_5$ by calcining with $NaCO_3$, $CaCO_3$ plus $CaO$, and $KNO_3$. Further studies showed the percentages of phosphorous soluble in $H_2SO_4$ when samples were calcined to temperatures ranging from 0° to 1,000° C, as well as that soluble in citric acid and ammonium citrate. Other tests were for the effect of (1) the length of time that solutions remained in contact with the samples; (2) calcining bauxite with other materials; and (3) variations in fineness to which the sample had been ground.

**Felton, W. J.** *See* Kitson, A. E.

**Ferguson, Herman White.** *See* King, P. B.

**Ferguson, R. F.** *See* Howe, Raymond M.

**Ferguson, W. H.**

1. Bauxite at Burgess Creek, Callignee, South Gibbsland: Victoria Geol. Survey Rec., v. 5, pt. 2, p. 292–293, Melbourne, 1936.

In the Parish of Callignee, Victoria, Australia, bauxite crops out along both sides of Burgess Creek and also in a small gully to the east where it is 12 feet thick. Chemical analyses of two samples show 37.40 and 32.73 percent alumina, 9.10 and 12.27 percent silica, and 22.21 and 24.84 percent iron oxide. The bauxite was derived from basalt.

2. Bauxite near Boolarra, Gippsland: Victoria Geol. Survey Rec., v. 5, pt. 2, p. 288–292, 1 pl., Melbourne, 1936.

The bauxite deposits described lie within 6 miles west and southwest of Boolarra which is 101 miles from Melbourne. The material is earthy, soft, and may be white, yellow, bluish, or reddish-brown. Chemical analyses of 10 samples indicate a range in composition from 41.30 to 58.22 percent alumina, 25.51 to 5.11 percent iron oxide, 4.76 to 4.23 percent titania, 2.76 to 2.14 percent insolubles, and 25.00 to 29.62 percent water.

**Fermor, L. Leigh.**

1. What is laterite: Geol. Mag., decade 5, v. 8, p. 454–462, 507–516, 559–566, 1911.

Laterite is defined as a decomposition product from which the combined silica, lime, magnesia, soda, and potash have been removed in solution and which consists largely of the residual accumulation of hydrated oxides of iron, aluminum, and titanium. Lithomarge is taken as the amorphous compound corresponding in chemical composition to kaolinite. A classification of such deposits is set up largely on the basis of percentage of lateritic constituents, that are more or less hydrated oxides of iron, aluminum, titanium, and manganese, present in the material. The main classes are: (1) lithomarge, clay, soils; (2) lateritic rocks; (3) siliceous laterites and lateritoids; (4) true laterites and lateritoids; and (5) varieties of (4), such as bauxite, iron ore, etc. Previous literature on the subject is reviewed. The application of the term bauxite to the highly aluminous laterites is discussed.

2. Bauxite, *in* Economic Inquiries: India Geol. Survey Rec., v. 45, pt. 2, p. 111–112, Calcutta, 1915.

In 1914 bauxite was discovered in three regions: (1) on the Peak and Plateau of Amarkantak in the Satpura range in the Central Provinces and in Rewah State; (2) on the Amagarh scarp in the Seoni district; and (3) in several localities south of Amagarh. The bauxite in all three regions is thick and appears to be of good quality.

3. The work of Professor Lacroix on the laterites of French Guinea: Geol. Mag., decade 6, v. 2, p. 28–37, 77–82, 123–129, 1915.

This paper is a detailed review of Lacroix' work (*see* Lacroix, 2).

4. Discussion of a paper by D. C. Wysor on "Aluminum hydrates in the Arkansas bauxite deposits": Econ. Geology, v. 11, no. 7, p. 686–690, 1916.

Referrring to Wysor's paper (see Wysor, 4), the author discusses the probability of the presence of aluminum hydrates as gibbsite, diaspore, and bauxite (dihydrate).

5. The mineral resources of the Central Provinces: India Geol. Survey Rec., v. 50, pt. 4, p. 268–302, 1 pl. (min. res. map), 1919.

*Aluminum ore (bauxite), p. 273–275.*—The richest bauxite deposits in India occur in the Central Provinces on the Baihir plateau in the Balaghat district, and near Katni in the Jubbulpore district. The deposits near Katni were first noticed in 1883; those of Jubbulpore, in 1905. Although these deposits are of large size and high grade, by 1919 they had not been mined because of high freight rates which made it impossible to export at a profit.

6. The mineral resources of Bihar and Orissa [India]: India Geol. Survey Rec., v. 53, pt. 3, p. 239–391, Calcutta, 1921.

*Aluminum-ore (bauxite), p. 250–252.*—The chief deposits of bauxite in India lie in the Central Provinces, Bombay, Bihar, and Orissa provinces, in order of importance. The aluminous laterite capping is shown by chemical analyses to be similar to the bauxite deposits in the rest of the world. In Orissa it overlies the Deccan Trap series at an altitude of about 3,200 feet above sea level. It also caps khondalite hills in Kalahandi State at altitudes of 3,200 to 4,000 feet.

**Ferrier, W. F.**

Bauxite and the possibility of its occurrence in British Columbia: Canada Munition Res. Comm. Final Rept. Nov. 1915–March 1919, p. 15–39, 19 pls., 1920.

A reconnaissance search for bauxite, made of the area between latitudes 50° and 50°15′ N. and longitudes 118°30′ and 122° W. showed the material reported from the area to be only a clay. No bauxite was found, and it is concluded that none exists in adjacent regions. The geology of the area is described in some detail.

**Fisher, N. H.** *See* Raggatt, H. G.

**Fleury, Ernest.**

Le sidérolithique suisse, contribution à la connaissance des phénomènes d'alteration superficielle des sédiments: Soc. fribourgeoise sci. nat., Géol. et géog. Mem., v. 6, Band 6, 13 figs., 260 p., 1909 [French].

The term siderolithic here refers to a complex geologic formation that is ordinarily characterized by the iron minerals in grains, oolites, and pisolites, occurring generally as a surficial accumulation. Bauxite and laterite (p. 31–34) are considered local forms of a siderolite and are relatively high in hydrous aluminum oxide. The bauxites as a group are extremely variable in alumina, iron, and silica content. Carbonic acid seeping downward is considered the principal cause in the formation of aluminum carbonate, which is unstable and decomposes to aluminum hydrate.

**Follett-Smith, R. R.** *See* Hardy, F.

**Fonseca Vaz, Teodôro A. da.**

Lateritização das rochas ricas em alumino-silicatos: Escola minas Rev., ano 9, no. 8, p. 339–342, 1944 [Portuguese].

Laterites, as the term is used here, are characterized by the formation of aluminum and iron oxides from the preexisting aluminum silicate rocks, through oxidation of the iron to the sesquioxide and removal of most of the silica, bases and the alkaline earths. The laterite is, therefore, rich in titanium, iron, and aluminum, and poor in silica. The phases postulated in the formation of laterite are: (1) the action of sulfuric acid waters on the country rock, breaking down the feldspars; and (2) the enrichment of the bauxite through the action of organic acids. The second is considered the more important.

**Foose, Richard M.**

High-alumina clays of Pennsylvania: Econ. Geology, v. 39, no. 8. p. 557–577, 7 figs. (incl. sketch maps and microphotographs), 1944.

The nodular and diaspore-bearing clays of central Pennsylvania occur chiefly in the Mercer member of the Pottsville group of Pennsylvanian age. More than 5 million tons of these high-alumina clays are estimated to occur in the Curwensville and Morgan Run districts in Clearfield County. The origin of the diaspore is discussed.

**Foote, R. Bruce.**

The lateritic formations, *in* Geology of the Madura and Tinnevelly districts [India]: India Geol. Survey Mem., v. 20, pt. 1, p. 44–55, 1883.

The laterite described herein consists largely of ferruginous conglomerates, sands, and gravels. In the northern part of the Madura and Tinnevelly districts the laterites are characterized by a very high iron content, chiefly as earthy hematite. Southward and southwestward, however, the iron content decreases until the series is finally represented by a thin bed of gravel, derived mostly from gneissic rocks.

**Formenti, Carlo.**

1. Analisi de supposte bauxiti italiane: Gazz. chim. Italiana, v. 31, p. 452–455, Rome, 1901 [Italian]; abs. Zeitschr. Krystallographie, Band. 37, p. 406, 1903 [German].

Chemical analyses, made by the author, of some supposed bauxite from Calabria Province, Italy, show approximately 51–73 percent silica and only 12–17 percent alumina.

2. Analisi di vere bauxiti italiane: Gazz. chim. Italiana, v. 32, pt. 1, p. 453–461, Rome, 1902 [Italian]; abs., Zeitschr. Krystallographie, Band. 40, p. 109, 1905 [German].

Bauxite in the vicinity of Lecce dei Marsi, Italy, occurs in shallow deposits which have relatively little overburden. The material is friable, and reddish to white in color. Methods of chemical analysis used in determination of silica, titania, alumina, iron, calcium and magnesium, water, and sulphate constitute a large part of the paper. The alumina content of the samples tested ranged from 51.13 to 57.52 percent.

**Fox, Cyril S.**

1. The bauxite resources of India: Min. Mag., v. 26, no. 2, p. 82–96, 10 figs., 1 index map, London, 1922.

The occurrence and chemical composition of bauxite deposits are described,

and the location shown on a small-scale map. The formation of primary (from which bauxite is derived) and secondary (Buchanan's) laterites is described. Possibilities for the production of alumina and aluminum in India are discussed.

2. The bauxite and aluminous laterite occurrences of India: India Geol. Survey Mem., v. 49, pt. 1, 287 p., 11 pls. (incl. photomicrographs and map 1:4,055,040), 1923.

Laterite is defined as consisting largely of the ferric hydroxide, $2Fe_2O_3.3H_2O$, whereas bauxite generally consists largely of the aluminum hydroxide, $Al_2O_3.3H_2O$. However, in most places bauxites and laterites occur as admixtures. The conditions under which laterite forms from rocks in place are: (1) a tropical climate subject to wet and dry seasons; (2) elevated or gently sloping land surfaces not subject to appreciable erosion (in India, not above 5,000 ft.); (3) rocks of suitable chemical and mineralogic composition and of a porous or finely divided texture (basalt, gneissose granite, khondalites, etc., in India); and (4) infiltering water that remains for long periods of time in contact with the rock, as in the wet season, but is practically absent in the dry season. The laterite deposits of India are described in Chapter 2; foreign bauxite localities in Chapter 3; and Chapter 4 consists of a bibliography.

3. Bauxite: 312 p., 18 pls., 2 photomicrographs, 9 figs., 6 maps, London, Crosby Lockwood and Son, 1927.

This book is the first edition of "Bauxite and Aluminous Laterite," published in 1932.

4. Bauxite and aluminous laterite; 2d. ed., 312 p., 28 photographs, 2 microphotographs, 14 figs., 6 maps, London, The Technical Press, Ltd., 1932.

In this edition of a standard reference book on bauxite, the term bauxite is restricted to "a sediment * * * which results when limestones or dolomites are removed in solution"; and the term aluminous laterite is reserved for deposits which are a weathering product of igneous rock and were formed by the removal of silica and the alkalies. Both materials are mixtures of the aluminum hydrates, but bauxite is defined as consisting primarily of the monohydrate, whereas aluminous laterite is primarily the trihydrate. A discussion of the origin includes a great many citations to the important work in the field.

About 100 pages are devoted to a description of the bauxite and aluminous laterite deposits of the world, which occur in Europe, Asia, Africa, North and South America, and Australia and lie either within or not far removed from the tropics. Most of the deposits are Cretaceous, Tertiary, or Recent in age. A discussion of mining methods, processing, the aluminum industry, and the uses of bauxite also covers about 100 pages.

5. Bauxite in Greece: Min. Jour., v. 185, p. 430, London, 1934.

Bauxite was first discovered in Greece in 1924. The deposits occur in central Greece in the mountains north of the Gulf of Corinth and in the mountains of Guione and Parnassas south and west of the railroad from Athens to Salonika. A typical analysis shows 2.3 percent $SiO_2$, 59.3 percent $Al_2O_3$, 22.85 percent $Fe_2O_3$, 3.5 percent $TiO_2$, 12.2 percent $H_2O$. Transportation by road or railroad is convenient. In the Gulf of Corinth, the ports of Aghia Marina, and Itea are suitable for shipping. The bauxite lies along the unconformity between the Jurassic and Cretaceous limestones.

6. Buchanan's laterite of Malabar and Kanara: India Geol. Survey Rec., v. 69, pt. 4, p. 389–422, 7 pls., 1936.

From the areas of laterite in Malabar and Kanara described in Buchanan's Journal in 1800–01, the present author collected samples of the material to which the name laterite was originally applied. In the 8 samples collected, free quartz

ranged from 4 to 26 percent; silica from 17 to 35 percent; alumina from 17 to 25 percent; and $Fe_2O_3$ from 4 to 39 percent. In three of the 8 samples, the percent of alumina was greater than that required by the amount of silica for the formation of kaolinite. A résumé is given of Max Bauer's work in the Seychelles. The terms laterite and lithomarge are discussed.

7. The mineral wealth of India: India Geol. Survey Rec., v. 76, Bull. Econ. Minerals no. 1, 23 p., 1 pl. (min. res. map), 1947.

*Bauxite, p. 13.*—The reserves of bauxite are estimated to be 250 million tons, "largely in Bihar, the Central Provinces, and Bombay, with a little in Madras." High-grade ore averages 55 percent $Al_2O_3$, 3 percent $SiO_2$, 6 percent $Fe_2O_3$, 8 percent $TiO_2$, and 28 percent $H_2O$. Small amounts of bauxite have been used for manufacturing alum, refining kerosene, and in high-alumina cement; no aluminum has been produced in India so far. Map shows location of mineral deposits.

**Franchi, Secondo.**

La morfologia e la genesi dei giacimenti di bauxite dell' Istria: Soc. geol. Italiana Boll., v. 43, p. 97–100, 4 figs., 1924.

The formation of bauxite and its occurrence in irregular pockets in limestone in the Istrian Peninsula, Italy, is discussed in relation to the physiographic history of the region.

**Franke, Herbert A.**

1. (and Herring, C. T.) Bauxite and aluminum: U. S. Bur. Mines Minerals Yearbook, 1937, p. 665–682, 2 figs., 1937.

Statistics on domestic and world production and consumption include the current and previous years. The production and uses of domestic and imported bauxite are discussed. A section on foreign bauxite and aluminum industries shows production figures, names of operating companies, types and locations of installations, areas mined, some chemical analyses, or information on grade of ore. The names of the producers and consumers of bauxite in the United States are listed. Production of bauxite and alumina are shown on graphs. Bauxite production for the year was larger than at any time since 1928; the aluminum industry also showed a corresponding increase.

2. (and Herring, C. T.) Bauxite and aluminum: U. S. Bur. Mines Minerals Yearbook, 1938, p. 577–595, 2 figs., 1938.

Statistics on domestic and world production and consumption include the current and previous years. A section on foreign bauxite and aluminum industries shows production figures, operating companies, types and locations of installations, areas mined, chemical analyses, or information on grade of ore. The names of the producers and consumers of bauxite in the United States are listed. Production of bauxite and aluminum is shown on graphs. Domestic production of bauxite was 30 percent higher than in 1936. The largest consumer of both domestic and imported ore was the aluminum industry, followed by the abrasive chemical, cement, and refractory industries.

3. (and Trought, Mary E.) Bauxite and aluminum: U. S. Bur. Mines Minerals Yearbook, 1939, p. 633–653, 2 figs., 1939.

Statistics on domestic and world production and consumption include the current and previous years. The production and uses of domestic and imported bauxite are discussed. A section on foreign bauxite and aluminum industries shows production figures, operating companies, types and locations of installations, areas mined, some chemical analyses, or information on grade of ore. The names of the producers of bauxite in the United States are listed. Production of bauxite

and aluminum ore is shown on graphs. Domestic bauxite production declined 26 percent in 1938. The proportion of domestic needs supplied by domestic mines was 60 percent in 1937, but only 47 percent in 1938.

4. (and Trought, Mary E.) Bauxite and aluminum: U. S. Bur. Mines Minerals Yearbook Review of 1939, 1940, p. 637–658, 2 figs., 1940.

Statistics on domestic and world production and consumption include the current and previous years. The production and uses of domestic and imported bauxite are discussed by industries. A section on foreign bauxite and aluminum industries shows production figures, operating companies, types and locations of installations, areas mined, chemical analyses, or information on grade of ore. The names of the consumers of bauxite in the United States are listed. Production of bauxite and aluminum is shown on graphs. Domestic bauxite production increased 21 percent over that in 1938. The increased demand came largely from the aluminum industry.

5. (and Trought, Mary E.) Bauxite and aluminum: U. S. Bur. Mines Minerals Yearbook, Review of 1940, p. 629–650, 2 figs., 1941.

Statistics on domestic and world production and consumption include the current and previous years. The production and uses of domestic and imported bauxite are discussed by industries. A section on foreign bauxite and aluminum industries shows production figures, operating companies, types and locations of installations, areas mined, chemical analyses, or information on grade of ore. Mining companies are shown, and the areas in which they operated. Production of bauxite and aluminum is shown on graphs. Spurred by a national defense program and demand by the aluminum industry, domestic production was 17 percent higher than in 1939. imports also were 21 percent higher than the previous year.

6. The light metals: Eng. Min. Jour., v. 143, no. 2, p. 46–49, 1942.

Estimated world production of bauxite and aluminum in 1939 and 1941, by countries, is given. The status of bauxite mining in the world and particularly the aluminum industry are discussed.

7. (and Trought, Mary E.) Bauxite and aluminum: U. S. Bur. Mines Minerals Yearbook, 1941, p. 655–684, 2 figs., 1943.

Statistics on domestic and world production and consumption include the current and previous years. The subjects discussed are: production and uses of domestic and imported bauxite; foreign bauxite and aluminum industries showing production figures, operating companies, types and locations of installations, areas mined, chemical analyses, or information on grade of ore, and technologic developments. Production of bauxite and aluminum are shown on graphs.

**Frary, Francis G.**

Aluminum in war: Chem. and Eng. News, v. 21, no. 23, p. 2018, 2019, 2042, 3 figs., 1943.

A discussion of the raw materials and power necessary to the production of aluminum forms the bulk of the paper. Bauxite resources and the problem of using lower grade material are mentioned briefly.

**Frederickson, A. F.**

Mode of occurrence of titanium and zirconium in laterites: Am. Mineralogist, v. 33, nos. 5–6, p. 374–377, 1948.

A study of a drill core of Arkansas bauxite indicated that titanium occurred as: sphene; ilmenite; a yellow, earthy material, largely brookite; and in substitution for aluminum in solid solution. Zirconium occurs as zircon crystals only in red,

unleached pisolites. Leached pisolites show corroded zircon. Zirconium is also found substituting for aluminum or adsorbed on aluminum hydroxide minerals as well as substituting for titanium in brookite.

**Freise, Fred W.**

Bauxitlagerstätten im Brasilianischen Staate Minas Geraes, Bildung von Bauxitlagern in Gegenwart: Metall und Erz, 88 Jahrg., Heft 21, p. 501–503, Berlin 1931 [German].

The Ouro Preto bauxite deposits of Minas Geraes, Brazil, occur along the north flank of the Itacolumy Mountains, half way between Ouro Preto and Marianna, and about 540 kilometers from Rio de Janeiro. The genesis of the deposits is suggested as being largely the result of the reaction of humic acid waters on the underlying rock, but is partly the result of similar reactions of water made acid by the decomposition of pyrite.

**Friedensburg, F.**

Kohle, Eisen und Bauxit in Jugoslawien: Glückauf, 75 Jahrg., nos. 46 and 47, p. 897–903, 913–919, 8 figs., 1939 [German].

The coal, iron, and bauxite deposits and production in Yugoslavia are described in separate sections. The bauxite deposits are geographically related to those in Italy and Hungary. Two types of deposits can be distinguished: (1) irregular fillings in fissures, caves, and sink-holes in the present karst surfaces; and (2) very regular and extensive occurrences on a karst surface of an older geologic horizon which was then overlain by younger strata, all of which were tilted in subsequent orogenic movements. Mining methods and production are given briefly. Chemical analyses show little difference between the two types of deposits. A typical analysis of younger bauxite shows 59.7 percent alumina, 26.8 percent iron oxide, 0.6 percent silica, 1.7 percent titania, and 11.2 percent water.

**Fróes Abreu, S.** *See also* Paiva, Glycon de.

Notas sôbre a bauxita da Laginha em Conceição de Muqui, Espírito Santo: Mineração e Metallurgia, v. 8, no. 47, p. 335–338, 6 figs., Rio de Janeiro, 1945 [Portuguese].

Bauxite occurs between Muqui Station and the Vila Conceição de Muqui and may also occur over much of the southern part of Espírito Santo. The predominant underlying rock is thought from poor exposures to be gneiss which has been weathered in place to form the bauxite. The climatic conditions of heavy rainfall, during a rainy season, followed by a dry season extend on the plateau from Paraiba to the coast and justify the possibility that bauxite occurs in the whole region. Four types of hard bauxite are described; analyses indicate approximately 58–62 percent alumina, 2–3 percent iron oxide, 2–12 percent silica, a trace of titania, and 27–32 percent water. Silica is disseminated throughout. It is thought that several thousand tons of bauxite could be mined here monthly.

**Fuchs, Th.**

Zur Bildung der Terra rossa: Austria, K.-k. geol. Reichsanstalt Verh., Jahrg. 1875, p. 194–196, 1875 [German].

In this very old paper, the terra rossa in the Mediterranean region is taken to indicate a warmer climate during the Tertiary period, when it was formed. The term terra rossa as used herein refers in general to red earthy accumulations in karst irregularities.

**Gardner, D. E.**

(and Ludbrook, N. H., compilers). Aluminum and bauxite: Australia Min. Res. Survey Summary Rept. no. 27, 19 p. 5 pls., 1946; Australia Bur. Min. Res., Geology, and Geophysics Summary Rept. 27, 23 p., 3 figs., incl. maps [1946].

The location, size, and geologic occurrence of Australian bauxite deposits, chemical analyses, reserves by districts, past production, and uses are given briefly. This paper is an excellent resumé of the known bauxite deposits and the industry in Australia. The sources of data are indicated. In Queensland bauxite occurs on the Tambourine Plateau south of Brisbane; in New South Wales the largest deposits are in the Tingha-Inverell-Emmaville and the Bundanoon-Wingello districts; in Victoria all known deposits are in South Gibbsland; in Tasmania bauxite deposits are scattered in the central part of the island; and in Western Australia the known deposits lie north and east of Perth.

**Gedeon, Tihamér.**

1. Die Enstehung pisolithischer Bauxite: Magyar. földt. társulat Földt. közlöny, kötet 61, p. 95–102, 2 figs., Budapest, 1932 [Hungarian, German summary].

Describes the characteristics of pisolitic bauxite. Some autochthonous bauxites have pisolites embedded in dust of their own substance, and others are surrounded by a foreign bauxitic substance. The embedding may have taken place on land giving rise to a loose structure, or in water which gives a well-cemented bauxite with calcite matrix. Thirteen chemical analyses are given of pisolites and their matrix. These show that silica and titania are consistently higher in the matrix than the pisolites, but iron oxide is greater in the pisolites.

2. Adatok a Sümegi Bauxitelöfordulâshoz—Daten vor Bauxitvorkommen in der Gegend von Sümeg: Magyar. földt. társulat Földt. közlöny, kötet 63, füzet 1–6, p. 96–97, Budapest, 1933 [Hungarian, German summary].

East of Sümeg, in the vicinity of O-Dörögd-Puszta, are pebbles of bauxite in Pliocene red clay. The pebbles constitute 4 to 5 percent of the mixture. Chemical analyses of 19 samples of the bauxite nodules and 3 of the clay matrix are included.

3. A Gánti bauxit-telep fedőrétegéről—Über die Hangendschicht des Gánter Bauxitlagers: Magyar. földt. társulat Földt. közlöny, kötet 62, füzet 1–12, p. 203–206, Budapest, 1933 [Hungarian, German summary].

A hole drilled in the Gánt bauxite district, Hungary, penetrated to a depth of 14.03 meters. Pisolitic bauxite in the bottom of the hole analyzed 42.40 percent alumina, 4.08 percent silica, 31.64 percent iron oxide, and 19.28 percent loss on ignition. Chemical analyses of the overburden are also included.

**George, P.**

Note sur les vestiges de surfaces d'aplanissement tertiares dans la région du bas Rhone: Congr. Internat. Géog., 13e, Paris, 1931, Comptes rendus, tome 2, fac. 1, p. 517–528, 1 fig., 1933 [French].

The remnants of the Tertiary (largely Eocene and Miocene) erosion surfaces and deformation in the lower Rhone region, France, and the relation of the bauxite deposits to it are discussed.

**Gildersleeve, Benjamin.** *See* Butts, Charles.

**Gillin, J. A.**

(and Shock, Lorenz, and Alcock, E. D.) An application of seismic surveying to the location of bauxite in Arkansas: Geophysics, v. 7, no. 4, p. 400–405, 3 figs. (incl. index map), 1942.

Bauxite deposits in Arkansas occur close to syenite outcrops on the Midway (Tertiary) surface. A refraction seismic survey mapped the high velocity formations (syenite and Paleozoic rocks). This, with drill hole data on the Midway formation, showed the configuration of the general land surface in Midway time.

**Ginsberg, I. I.**

The physical chemistry of bauxite deposits formation [title of summary]: Akad. nauk SSSR Izv., Ser. geol., no. 4, p. 6–11, 1942 [Russian, English summary].

A study of bauxite deposits indicates that they are formed by the operation of two processes: leaching of silica, and the addition and migration of alumina.

**Gladkovskiy (Gladkovsky), A. K.**

1. Eifelian and Givetian bauxite deposits of Iss and south parts of Serov districts and lower-Ludlow productive series of Iss district: Akad. nauk SSSR Izv., Ser. geol., no. 4, p. 35–46, 3 figs., Moscow, 1942 [Russian, English summary].

The detailed stratigraphic location and the genesis of the Silurian and Devonian bauxite deposits in the Serov and Iss districts in the Central Ural, U.S.S.R., are presented.

2. Novyye dannyye o boksitonosnosti vostochnogo sklona Srednego Urala (New data on the bauxite occurrences of the eastern slope of the Middle Urals): Akad. nauk SSSR Izv., Ser. geol., no. 3, p. 19–26, Moscow, 1943 [Russian, English summary].

In the Paleozoic of the middle Ural Mountains, U.S.S.R. bauxite was found in Givetian and Eifelian sediments near Alapaevsk and in Eifelian sediments near Serov.

**Glaser, K.**

Glina boksytowa grudkowska jako surowiec dla przemyslu chemicznego: Przemysł Chemiczny, v. 20, no. 1, p. 1–3, Warsaw, 1938 [Polish].

The author discusses the possibility of using the bauxitic clays from Grudkow, Poland, for aluminum production. The clays contain from 45 to 73 percent $Al_2O_3$, and from 22 to 50 percent $SiO_2$. †v. 11, no. 2.

**Goldich, Samuel S.** (*See also* Bridge, J.; and Hendricks, Sterling B.).

1. (and Bergquist, Harlan R.) Aluminous lateritic soil of the Sierra de Bahoruco area, Dominican Republic, W. I.: U. S. Geol. Survey Bull. 953-C, p. 53–84, 5 pls., 3 figs., 1947.

Aluminous lateritic soil occurs in savannas on the southwestern slope of the Sierra de Bahoruco in the Dominican Republic. The nine deposits studied in the Aceitillar area lie 4,000 to 5,000 feet above sea level on an irregular surface on Eocene limestone. Composite samples contain 46–49 percent alumina, 19.4–20.6 percent iron oxide, and 1.6–5.2 percent silica. Reserves for the area are estimated to be 6 million long tons. In the Bucan Polo area, the lateritic soil lies on limestone of middle or late Oligocene age, about 1,250 feet above sea level. This material averages 42 percent alumina, and 10 percent silica; reserves

re estimated to be between 2.5 and 5 million long tons. Chemical analyses of he Eocene limestone in the Aceitillar area show it to be a relatively pure calcium arbonate that contains less than 0.1 percent alumina, so that a very large volume f this limestone would be necessary to produce the overlying soil. It is suggested that the lateritic constituents may have been derived from other sources, and that the soil is inherited. Detailed studies are necessary to determine the geologic section available for weathering.

2. (and Bergquist, Harlan R.) Aluminous lateritic soil of the Republic of Haiti, W. I.: U. S. Geol. Survey Bull. 954-C, p. 63–111, 4 figs., 2 pls., 1948.

The largest deposits of aluminous lateritic soil in Haiti occur in the Southern Peninsula on the Rochelois Plateau. Reserves are estimated to be about 15 million long tons, of which about 10 million are recoverable. The average chemical composition is 46.8 percent $Al_2O_3$, 3.4 percent $SiO_2$, 2.8 percent $TiO_2$, 21.9 percent $Fe_2O_3$, and 24.1 percent $H_2O$. Similar but smaller deposits occur (1) at Beaumont, (2) in the vicinity of Savane Zombi, and (3) Savane Terre Rouge. The lateritic soil is finely divided, reddish- and yellowish-brown and buff-colored. The principal minerals are gibbsite, boehmite, and goethite; quartz, zircon, and magnetite are accessory. Chemical analyses of the underlying Eocene limestone showed it to be very pure calcium carbonate. If this limestone were the source of the soil, a very large volume would have been required. It is suggested on the basis of the chemical composition of the soil, that an igneous parent material of intermediate composition is the ultimate source.

3. Origin and development of aluminous laterite and bauxite [abs.]: Geol. Soc. America Bull., v. 59, no. 12, pt. 2, p. 1326, 1948.

"Aluminous laterite and bauxite form directly by weathering of igneous rocks above the water table in regions where climate, topography, rock types, and possibly other factors are favorable. Below the water table clay minerals are favored as the end product of weathering. For this reason bauxite deposits commonly grade downward to clay which in the earlier literature has been referred to as a 'transitional' clay between bauxite and the parent rock.

"The clay layer is a normal product in tropical regions where weathering has progressed deep enough and where physical conditions permit establishment of a permanent water table. In this zone kaolin minerals . . . develop either by direct crystallization or by silication of aluminum hydroxide.

"The establishment of a permanent water table in a deep weathering profile marks the end of the cycle of laterization and a physical-chemical change from conditions favoring gibbsite development to those favoring clay minerals. . . .

"In the late stage of weathering, secondary processes are initiated which bring about a redistribution of the constituents in both laterite and in the underlying clay."—*Author's abstract.*

**Goldman, Marcus I.**

1. (and Tracey, Joshua I., Jr.). Relations of bauxite and kaolin in the Arkansas bauxite deposits: Econ. Geology, v. 41, no. 6, p. 567–575, 7 figs., 1946.

Field relations of the bauxite and kaolin in the Arkansas deposits suggest that residual bauxite was derived directly from the underlying nepheline syenite by weathering, rather than from the kaolinized nepheline syenite. It is considered that kaolinization or silication of bauxite is more common than is generally recognized; the evidence of this process is largely seen in veins of kaolin in bauxite, and in remnants of bauxite surrounded and penetrated by kaolin. The underlying kaolinized nepheline syenite is derived directly from the parent rock, but is separated from bauxite by a compact kaolinitic clay formed by the kaolinization of bauxite.

2. Bauxitization—a tropical disease [abs.]: Wash. Acad. Sci. Jour., v. 39, no. 3, p. 107, 1949.

A study of the bauxite deposits of Arkansas suggests that the bauxite has been formed directly from nepheline syenite not from the structureless kaolin which at present lies between the two. The bauxite and the kaolin were formed separately. The author suggests that climatic factors alone may not be sufficient to cause such a difference in weathering products but that it possibly involved the participation of microorganisms.

3. Petrology of bauxite surrounding a boulder-like core of kaolinized nepheline syenite in Arkansas (Exhibit): Geol. Soc. America Bull., v. 60, no. 12, pt. 2, p. 1890–1891, 1949.

This abstract refers to an exhibit consisting of a series of thin section slides through a bauxite boulder from Arkansas, in which the bauxite surrounds a zone of kaolinitic material and an innermost core in which are remnants of decomposed feldspars. In weathering, it is considered that the feldspars were altered to finely crystalline gibbsite, followed by alteration of the gibbsite to a more amorphous and concretionary bauxite. The subsequent kaolinization of these products was effected by the addition of silica from the further decomposition of the nepheline syenite core.

**Goldschmidt, V. M.**

Om dannelse av laterit som førvitringsproduct av Norsk labradorsten: Saertrykk av Festskrift til H. Sørlie, p. 21–24, Oslo, 1928 [Norwegian]; summary, Neues Jahrbuch., 1929, Referate, II, p. 421–423 [German].

A study of the lateritic weathering products of Norwegian labradorite shows the material to have a chemical composition such that the alumina content of the fraction less than 0.002 millimeter in diameter is roughly twice the silica content. A thin section of the labradorite rock showed it to contain 70–70 percent of anorthite-rich plagioclase. It is considered, therefore, that laterite may form under semiarctic conditions, provided the parent rock is high in anorthite.

**Goloubinow, R.**

Les bauxites de Tougue: French West Africa, Service mines Bull. 1, p. 78–80, 2 figs., Dakar, 1938 [French].

The bauxite occurs in the area surrounding Tougue, in Guinea, French West Africa, as a lateritic bauxitic cover which analyzes as much as 70 percent alumina and less than 5 percent impurities. However, because of the distance from shipping ports and the high cost of rail transportation, it cannot compete commercially with bauxite from elsewhere.

**Goodchild, J. H.**

Laterization in Minas Geraes, Brazil: Inst. Mining and Metallurgy Trans., v. 23, p. 2–54, 4 figs., London, 1913.

The origin of the laterite which overlies schist in parts of Minas Geraes, Brazil, is treated in an unorthodox manner. The term "digested" is used to designate the weathering process. Because of hardening of the laterite at the surface, mechanical erosion appears to proceed largely as a series of landslips of large masses into large or even very small valleys. For the 16 pages of original text, there are 36 pages of discussion including final remarks by the author to clarify his position.

**Gordon, C. H.**

1. Bauxite: Mineral Industry, 1913, v. 22, p. 47–58, 1914.

Statistics on domestic production by States, imports, exports, and consumption are for the years 1903–13. The operating companies and producing mines are described in short sections on Arkansas, Georgia, Alabama, and Tennessee. Producing areas in foreign countries are mentioned in a short section. The uses of bauxite and other sources of aluminum are also discussed.

2. Bauxite: Mineral Industry, 1914, v. 23, p. 30–40, 1915.

Statistics on domestic production by States, imports, exports, and consumption are for the years 1905–15. The domestic bauxite industry is described by States. The bauxites of France are described briefly.

**Gordon, Mackenzie, Jr.** (*See also* Bryson, R. P.).

(and Tracey, Joshua I., Jr., and Ellis, Miller W.) Field relations of Arkansas bauxite deposits (abs.): Geol. Soc. America Bull., v. 60, no. 12, pt. 2, p. 1891–1892, Dec. 1949.

"Studies during the war indicate four principal types of bauxite deposits in the Arkansas bauxite region. Their occurrence is controlled by the source rocks, physiography of the ancient land surface on which they formed, and stratigraphic history of the region.

"(1) Residual deposits on higher slopes of buried nepheline syenite hills have a lower zone, preserving the granitic texture of the original rock, and an upper concretionary zone. They are separated from fresh nepheline syenite by kaolinitic clay that, adjacent to the bauxite, appears massive or fragmental.

"(2) Colluvial deposits on lower slopes along the buried edge of sediments of the Midway group have a lower zone locally preserving clay textures, a thicker concretionary zone above, and commonly upslope a siliceous hardcap. They grade into a surrounding kaolinitic envelope. Their deposition was contemporaneous with that of early Wilcox lignite, gray clay, and sand farther downslope.

"(3) Alluvial deposits, composed of stratified, sorted, and crossbedded pebbles, pisolites, and grains of bauxite, overlie and fill channels in colluvial bodies and tongue into the early Wilcox sediments.

"(4) Alluvial deposits, mostly bauxite boulder beds, overlie residual deposits or early Wilcox sediments and tongue into later Wilcox sediments, particularly as the basal conglomerate of a dark chocolate-brown clay and sand unit that unconformably overlies the lignite, gray clay, and sand unit.

"The first two types are the source of most of the ore in the region, but all four have been mined."—*Authors' abstract.*

**Gorsky, V.**

Geofizičko istraživanje naših boksita: Rudarski i topionički Vesnik. 1, Heft 8, p. 350–356, Belgrade, 1929 [Yugoslavian, French summary].

Geophysical exploration for bauxite deposits in Yugoslavia is described.

**Gortani, Michele.**

1. Terra rossa, bauxite, laterite: Gior. geologia prakt., anno 11, fasc. 1, p. 21–39, 1913 [Italian]; abs., Geol. Zentralbl., Band 20, no. 1, p. 100, 1913 [Italian].

The aluminous materials, consisting largely of the hydroxides of aluminum and iron together with a small percentage of impurities are defined as: (1) terra rossa, the insoluble residue from the weathering of limestones and dolomites; (2) bauxite, which from the practical, lithologic, and geologic point of view is reserved for

deposits of hydroxides that are within limestone formations, is actually ancient terra rossa; and (3) laterite, the weathering product derived from silicate rocks.

2. Sull'origine delle bauxiti italiene: Gior. geologia prakt., v. 16, p. 1–6, 1921 [Italian].

Bauxite in Italy, as well as that in Dalmatia (Yugoslavia), overlies limestone of Cretaceous age and is overlain by only relatively thin beds. The bauxite occurs in irregularly-shaped pockets and lenses in the limestone. Theories of the origin and formation of bauxite discussed include the questions of subaerial erosion of the limestone and of transportation and deposition of the bauxite. The work of other authors is cited.

**Gould, Robert F.**

Alumina from low-grade bauxite: Indus. Eng. Chemistry, v. 37, no. 9, p. 796–802, 7 figs., 1945.

A combination process for the recovery of alumina from the red mud waste of the Bayer process and from low-grade bauxite was devised and put into operation in 1943 at the Hurricane Creek plant in Arkansas and at the East St. Louis plant in Illinois. The red mud is mixed with ground limestone and soda ash and roasted at 1800°–2000° F. The sinter is then leached with water and the filtrate is again put thru the Bayer process when the alumina and soda ash are recovered.

**Grange, L. I.** *See* Seelye, F. T.

**Gribaudi, P.**

La produzione italiana dell' alluminio: R. soc. geog. Italiana Boll., ser. 6, v. 8 (68), p. 611–633, 4 figs., 1931 [Italian].

This paper gives a general history of the development of the processes used in the commercial production of aluminum. The amount of production and the centers of the industry are indicated for the important countries. The location of the bauxite areas of Italy is shown, on maps of the Salentina Peninsula (Lecce and Gallipoli areas) and the Istrian Peninsula. Mine production by districts is given for the years 1920–28. The production, imports, and uses of aluminum are also given.

**Grim, Ralph E.**

(and Rowland, Richards A.) Differential thermal analyses of clay minerals and other hydrous materials: Ill. State Geol. Survey Rept. Inv. 85, p. 746–818, 14 figs.; Am. Mineralogist, v. 27, no. 11, p. 746–761, 7 figs.; no. 12, p. 801–818, 7 figs., 1942.

Differential thermal curves are figured for a large number of clay minerals, related silicates, and iron and aluminum hydroxides. The significance of the curves with regard to the lattice structures is discussed. Curves are also shown for mixtures of these minerals, and the possibilities of thermal analysis methods in identifying and estimating relative abundance of the constituents in mixtures are indicated.

**Grossouvre, A. de.**

Observations sur l'origine du terrain sidérolithique—Analogies avec certains dépôts triasiques: Soc. géol. France Bull. 3e sér., tome 16, p. 287–289, 2 figs., 1888 [French].

The iron in the siderolithic mantle occurs in the form of small, round concretions. The Jurassic limestones in contact with the deposit have developed a crystalline texture and the action of water on them at the time of formation of

he iron is considered responsible. The siderolith under the microscope is seen o consist of very irregular pieces of quartz, together with rare fragments of ourmaline and rutile, in a very fine-grained matrix. It is concluded that the eposits are the result of chemical reactions of waters charged with silica, iron xide, and other substances.

**uimarães, Djalma.**

(and Coelho, Ifigênio Soares). Bauxita do Morro do Cruzeiro em Ouro Preto, Minas Gerais: Brazil, Div. Fomento Produção Min., Bol. 67, 40 p., 7 pls., 1945 [Portuguese].

The bauxite deposits on the Morro do Cruzeiro are about a kilometer from )uro Preto station. The genesis of bauxite is discussed with a review of the ertinent literature. Outcrops of fresh rock were not found in the vicinity, but rom geologic and stratigraphic studies, bedrock is concluded to be a sericitic-ematitic phyllite. The bauxite is due to laterization, or removal of silica and he bases with consequent increase in percent of alumina and iron. Chemical nalyses of washed ore average 5 percent silica, 12 percent iron oxide, 53 percent lumina, 2.2 percent titania, and about 26 percent water. A map and cross ections are included.

**yörgy, A.**

Bauxittelep Halimbam és körn veszprém varmegyégen [Hungary]: Bányászati és kohászati lapok, Band 56, füzet 7–8, Budapest, 1923 [Hungarian].

**yörki, Jozsef.**

Die Dehydratation der Bauxite und Bauxitmineralien: Magyar földt. társulat Földt. közlöny, v. 61, p. 64–94, 3 figs., 1932 [German, Hungarian abs.].

Chemical analyses and thermal dehydration curves of samples of hydrargillite (gibbsite), diaspore, limonite, kaolinite, and mixtures of these with quartz in bauxite samples are presented. The percentages of water loss for each 25° C up to 1000° C are tabulated for these minerals. The total loss is seen to be that required by the chemical formula. The breaks in the curves are shown to be charactertistic and a useful method of identification. The study also indicated that most of the silica in bauxites occurs as kaolinite.

**Haenig, A.**

Bauxit und Aluminium: Berg- u. Hüttenm. Jahrbuch., Band 56, p. 240–266, 1908 [German].

This paper is a general discussion of the known bauxite deposits of the world, the history of the aluminum industry, and the uses of bauxite and aluminum. Statistics on world production of bauxite and aluminum are included.

**Haigh, W. D.** *See* Cole, Greenville A. J.

**Hancock, David.** *See* Phillips, William B.

**Hand, William Flowers.** *See* Morse, P. F.

**Hanlon, F. N.**

The bauxites of New South Wales, their distribution, composition and probable origin: Royal Soc. New South Wales Jour. and Proc. 1944, v. 78, pt. 3, p. 94–112, 2 figs., 2 pls., 1945.

The bauxites of New South Wales, with but one exception, overlie Tertiary basalt flows. These basalts, from which the bauxites were derived by weathering, are probably Oligocene in age. Laterite is widespread on other types of rocks and is associated with a Tertiary peneplain. Lateritization is considered to have taken place over a wide area during Miocene time when the land surface was relatively flat and at a low (sea level to 2,000 feet) elevation. Where the bedrock was basalt or other low-silica rock, bauxite was the end product; elsewhere a siliceous or iron laterite formed. Lateritization is defined as the process of removing silica, alkalies, and the alkaline earths from a profile.

Although some of the bauxite in New South Wales is high grade, most of it is high in iron. The average composition of the bauxite from the Tingha-Inverell-Emmaville district shows 39.5 percent alumina, 4.5 percent silica, 30.0 percent iron oxide, 4.0 percent titania, and 22.0 percent water. The Bundannon-Wingello deposits are very similar but are slightly lower in alumina and higher in iron oxide contents. The bauxite is reddish-brown and generally pisolitic. Thin sections show the laths of the original feldspar to consist of aggregates of gibbsite crystals. In many areas the deposits overlie kaolinized basalt. The bauxite deposits are considered to be residual deposits formed by a lateritic process in a warm climate with moderate rainfall.

**Harder, E. C.**

1. Bauxite: Eng. Min. Jour., 59th Ann. Rev. Number, v. 125, no. 3, p. 93. 1928.

This brief article presents the world mining picture in 1926 and 1927. The principal mining areas and grades of ore shipped are indicated.

2. Ores of aluminum, *in* Edwards, J. D., editor, The aluminum industry, v. 1, p. 60–123, 17 figs.: New York and London, McGraw-Hill Book Co., Inc., 1930.

A general discussion of the ores of aluminum and their occurrence in the world, this paper includes brief descriptions of bauxite, laterite, Terra Rossa, bauxitic clay, and diasporic clay. The four main types of deposits are the blanket (occurring at or near the surface in horizontal sheets or lenses), interlayered (lying at definite stratigraphic horizons), pocket (irregular masses enclosed in limestone or clay), and detrital types (transported and redeposited material of the other three types). Theories advanced for the origin of bauxite are discussed, and it is concluded that, although little is known of the chemistry of laterization, the end products of rock decomposition are laterites, bauxites, and lateritic iron ores. A short section on mining and milling of the ore is also included.

3. Origin of bauxite deposits (discussion): Econ. Geology, v. 28, no. 4, p. 295–398, 1933.

In discussion of C. H. Behre's paper in volume 27 (See Behre, C. H., Jr.) it is pointed out that the lignite deposits which commonly overlie bauxite beds are not necessarily related to the formation of bauxite but were probably laid down following the lateritization or bauxitization. Bauxite deposits overlain by lignite are characterized by iron in the ferrous form, as carbonate, sulfate, or sulfide. The difficulties in the formation of aluminum hydrate from aluminum sulfate are discussed.

4. British Guiana and its bauxite resources: Canadian Inst. Mining and Metallurgy Trans., v. 39, p. 739–758, 20 figs., 1936.

The geographic features and the geologic history of British Guiana are described briefly. The area consists of three geographic belts: a low, flat coastal strip; a foothills belt; and an interior upland. Bauxite occurs in the foothills

lt and is exposed where streams have eroded through the recent sediments. ıe deposits, 25 feet or more in thickness, are overlain by sand and clay and ıd underlain by kaolin. The Demerara bauxite plant is 65 miles up the Deerara River at the town of Mackenzie. The mining methods and beneficiation ocesses used here are discussed. A section on Uses of bauxite is also included.

5. Bauxite, *in* Industrial minerals and rocks, nonmetallics other than fuels, 2d ed., p. 95–118 (1st ed., p. 111–128, 1937): New York, Am. Inst. Min. Metall. Eng., 1949.

This comprehensive résumé on bauxite includes sections on the composition ıd properties, mode of occurrence, origin, distribution of deposits of the world, ɔlitical and economic control, production and consumption, prospecting, exoration, mining, marketing, and uses.

6. Stratigraphy and origin of bauxite deposits: Geol. Soc. America Bull., v. 60, no. 5, p. 887–908, 1949; abs., v. 58, no. 12, pt. 2, p. 1188, 1947; repr., Geol. Assoc. Canada Proc., v. 1, no. 1, 1949.

This paper constitutes a review of the stratigraphic position and location of the ıuxite deposits of the world, as well as an evaluation of the prevailing theories origin. The known deposits range from Devonian to Recent in age; they are ratigraphically significant because they indicate periods of emergence and ondeposition in which subaerial weathering conditions, together with relatively ttle mechanical erosion, predominate. The most important commercial ore ccurs in deposits of Early Cretaceous (Albian), Late Cretaceous (Senonian), ırly Eocene, Miocene, Pleistocene, and Recent age. Bauxite may result from ıe weathering of many types of rocks or their weathered derivatives, but the ıost important occur on limestone. diorite, syenite, phonolite, granite, metaıorphosed volcanics, arkose, slate, phyllite, basalt, and sedimentary clays. t is considered that, although bauxite can be formed directly from fresh rock ithout the intermediate formation of kaolin, it can also be formed from kaolin.

**Iardy, F.**

1. Studies in tropical soils—I. Identification and approximate estimation of sesquioxide components by adsorption of alizarin: Jour. Agr. Sci., v. 21, p. 150–166, London, 1931.

The alizarin adsorption method discovered by Schmelev has been applied ı modified form to make an approximate estimate of the free alumina and hyrous iron oxide components of clays and other materials. Details of the procedure nd some preliminary results are presented, and also an outline of similar proedures using other reagents.

2. (and Follett-Smith, R. R.). Studies in tropical soils—II. Some characteristic igneous rock soil profiles in British Guiana, South America: Jour. Agr. Sci., v. 21, p. 739–761, London, 1931.

Five typical soil profiles from British Guiana were sampled. These were lerived from igneous rocks of different composition. Each had produced a andy, acidic, nutrient-deficient surface soil under similar humid-tropical condiions, but the intermediate products were different. The igneous rocks of ɔasic and intermediate composition are directly overlain by a "primary gibbsitic aterite" covering the rock in a thin crusty layer. Above this layer the gibbsite ıas been resilicated, at least partly, to form the kaolinitic earths. In the most ɔasic profiles, the residual gibbsite and iron oxides accumulated as concretionary ravelly masses. The igneous rocks of acidic composition are directly overlain ɔy kaolinitic earths. Silica occurs also as secondary quartz. Three zones have ɔeen differentiated: of alteration, secondary changes, and leaching. The

authors have used the alizarin adsorption method for determining the percentage of gibbsite and hydrous iron oxides (see Hardy, 1) and have added further data on the determination of iron minerals by this process.

3. (and Rodrigues, G.). Soil genesis from andesite in Grenada, British West Indies: Soil Sci., v. 48, no. 5, p. 361–384, 1 fig., 1939.

Various laboratory methods were investigated for quantitative determination of the mineral constituents in the several stages of the formation of a red soil from andesite bedrock. The principal methods used were chemical analysis of whole samples and the colloid fractions, microscopic study, thermal dehydration studies, and dye adsorption tests.

4. (and Rodrigues, G.). Soil genesis from fragmental volcanic rocks in the Lesser Antilles: Soil Sci. Soc. America Proc., v. 6, p. 47–51, 1 fig., 1941.

The Lesser Antilles consist almost entirely of extrusive volcanics of Miocene age, which form the basement rocks, and of Pleistocene age. Azonal, intrazonal (both calomorphic and hydromorphic), and zonal soils are described; their genesis and the nature of underlying beds are mentioned briefly.

**Harper, L. F.**

Aluminum (alunite and bauxite): New South Wales Dept. Mines, Geol. Survey Bull. 8, 17 p., Sydney, 1924.

The chemical and mineralogic composition of bauxite, its origin, and world production are briefly discussed. In New South Wales, bauxite occurs in the Wingello district, 100 miles south of Sidney on the Southern Railroad. The ore caps low hills of Tertiary material. The Tertiary is overlain by basalt lava flows except on these bauxite-capped hills which probably never were covered. The ore is composed of rounded grains (2 millimeters to 8 centimeters in diameter) in an earthy, sandy groundmass.

Similar deposits have been found at Emmaville in Gough County, at Inverell in Hardinge and Arrawatta Counties, and at Tingha in Gough, Hardinge, Swinerton, and Herbert Counties, New South Wales.

**Harper, Roland M.**

Natural resources of the Tennessee Valley region in Ala.: Ala. Geol. Survey Special Rept. 17, 93 p., 3 figs., 1942.

Bauxite is briefly mentioned as occurring in western Colbert County where the Cretaceous overlaps the Paleozoic. There has been no production from the deposit.

**Harrassowitz, Hermann L. F.**

1. Die Entstehung der Oberhessischen Bauxite und ihre geologische Bedeutung: Deutsche geol. Gesell., Zeitschr., Band 73, B. Monatsh. Nr. 8–10, p. 179–193, 8 figs., 1921 [German].

The bauxite deposits of Hesse, Germany, are considered to have originated from the simple weathering of basalt in Pliocene time. The occurrence of the bauxite, its relation to other sediments, and the geologic implications are discussed. Weathering processes in general are considered briefly.

2. Laterit, Material und Versuch erdgeschichtlicher Auswertung: Fortschr. Geologie u. Palaeontologie, Band 4, Heft 14, p. 253–266, 43 figs., 1 pl., 1926 [German].

This paper is a treatise on the formation of kaolinite, hydrous aluminum oxides, iron oxides, and related substances by weathering processes. The stages in the

ocess are indicated by: (1) the zone of fresh rock; (2) the zone of decomposed ck, which retains the original texture; (3) the mottled zone, in which is the ginning of the formation of allite (gibbsite); and (4) the iron crust zone, which enriched in iron compounds, aluminum silicates, and hydrous aluminum oxides. terites in process of formation and fossil laterites are discussed in detail. ecial reference is made to the bauxite deposits of the Vogelsberg, in Germany.

3. Bauxitstudien: Metall u. Erz, 24 Jahrg., Heft 8, p. 181–182, 1927 [German].

Bauxite is defined as a rock consisting largely of colloidal aluminum monodrate; laterite consists largely of the trihydrate; and allite is a general name a rock consisting principally of aluminum hydrates. The term allite is comunded of the two words aluminum and lithos. The factors of mechanical ovement and chemical weathering in the formation of bauxite deposits, in gions where they discordantly overlie limestone and in regions of karst topogphy, are discussed.

4. Die weltwirtschaftlich wichtigste Bauxitausbildung: Metall u. Erz, 24 Jahrg., Heft 24, p. 589–591, 1927 [German].

Two types of allite are defined: those high in water content, low in iron, and sily soluble are called laterite; and those low in water, high in iron, and soluble ith difficulty are called bauxite. It is suggested that bauxite, the monohydrate aluminum, be called monohydrallit, and that laterite, the trihydrate, be called ihydrallit. The formation of the monohydrate is related to metamorphic prosses, whereas the trihydrate is simply a weathering product which in some rts of the world has been covered by more recent sediments.

5. Südeuropäische Roterde: Chemie der Erde, Band 4, Heft 1, p. 1–11, 1928 [German].

The author's work indicates that the south European roterde (red earth) is an uvial horizon and that the weathering profile of it corresponds with an upper umus horizon in German soil. In karst regions there is a similarity between the oterde and the monhydrallite deposits because of the tendency toward destruction of the profiles by surficial erosion. Terra rossa is found only on pure limeones and is characteristic of Mediterranean weathering, although red soil one is not.

6. Allit-(Bauxit-) Lagerstatten der Erde: Naturwiss., 17 Jahrg., Heft 48, p. 928–931, 1929 [German].

7. Anchimetamorphose das Gebiet zwischen Oberflächen- und Tiefenumwandlung der Erdrinde: Oberhess. Gesell. Natur- und Heilkunde Ber., Neue Folge, Band 12, p. 11–17; 30–39, Giessen, 1929 [German].

Both siallite (hydrous aluminum silicate) and allite (aluminum trihydrate—ibbsite or hydrargillite) are produced by subaerial weathering. The monohyrate of aluminum is considered to form from the trihydrate under minor tectonic ressures (anchimetamorphism). Continued or extreme pressure results in the ormation of corundum. The discussion of the aluminum minerals constitutes nly a small part of this paper which covers the minor metamorphism of all types f sedimentary rocks.

8. Laterite, *in* Handbuch der Bodenlehre, Band 3, p. 194–257; Band 4, p. 225–305: Berlin, Julius Springer, 1930.

9. Silicium, Aluminium, Eisen im Wechsel der Verwitterungsvorgänge: Zeitschr. angew. Chemie, 43 Jahrg., p. 185, 1930 [German].

10. Tropischer Bauxit: Metall u. Erz, 38 Jahrg., Heft 10, p. 221–225, 3 figs., 1941.

Tropical regions that have high precipitation and temperature are characterzed by rapid and deep weathering of rocks; the silicate rocks weather everywhere

to form siallite and allite. Where the climate is seasonal, as in savanna areas there is an enrichment in alumina due to a rising of alumina-bearing water during the dry season. Evaporation at the surface causes precipitation of the alumina and consequent enrichment there. The German colonies, especially Togo in Africa, are considered to be favorably located for the occurrence of commercial deposits of bauxite.

**Harrington, J. F.**

Sources of bauxite in Asia: Allied Powers GHQ Tokyo, Nat. Res. Sec. Prelim. Study 26, 23 p., 15 figs., June 1, 1948; U. S. Bur. Mines Min. Trade Notes, Special Supp. 27 (to v. 26, no. 6), 17 p., 13 figs., June 1948.

Bauxite is known to occur in Asia and the Pacific on Bintan Island in Indonesia; on the Palau Islands in the Carolines, near Johore and Malacca in Malaya; in Shantung Province, China; French Indo-China; and India. Japan's former aluminum industry was based largely on ore from Bintan, the Palau Islands, and Malaya. The location of deposits, working conditions, mining methods, and reserves are given where known for bauxite districts listed above.

**Harris, Florence E.**, and **Trought, Mary E.**

[Compilers, Sept. 1936–date and Oct. 1939–date, respectively]: U. S. Bur. Mines Mineral Trade Notes, v. 1, no. 1 (1935) to v. 31, no. 6, 1950.

These volumes, compiled in the Economics and Statistics Division of the Bureau of Mines, are worldwide in scope, presenting "a monthly inventory of information from the U. S. Government Foreign Service offices and other sources that may not otherwise be made available promptly." Information may include mining and mining areas, statistics on production, consumption, imports, exports, or prices, and political or economic control of deposits.

**Harrison, Sir John Burchmore.**

1. The residual earths of British Guiana commonly termed laterite: Geol. Mag., decade 5, v. 7, no. 10, p. 439–452; no. 11, p. 488–495, no. 12, p. 553–562, 1910.

Studies indicate that the presence of free alumina in the residual earths of British Guiana is characteristic of those derived from igneous rocks whose feldspars are largely of the albite-anorthite series; kaolinite or sericitic micas appear to be derived from rocks high in alkali feldspars. Chemical and mineralogic analyses of rocks of many types and of the overlying residual material are given. In reference to Buchanan's laterite as a material which hardens on exposure: analysis of one type shows 44 percent orthoclase rock powder with some aluminum and iron oxides; two oolitic types, largely kaolin, one of which is high in iron, contain only minor amounts of alumina. Thus a high alumina content is not necessarily concomitant with the property of hardening. Studies were made of percentage loss of constituents in rock weathering. The author suggests that the occurrence of laterites in places having hot moist climates is due, not to its having formed only there, but to its preservation in tropical areas and its removal in temperate areas by erosion, frost-action, etc.

2. Formation of a laterite from a practically quartz-free diabase [Pt. I]: Geol. Mag., decade 5, v. 8, no. 3, p. 120–123, 1911.

Near Christianburg on the Demerara River, British Guiana, a practically quartz-free diabase boss is covered by laterite. A study was made of a boulder of the diabase which was found in the laterite, the outer parts of which were altered. Chemical and mineralogic analyses made of the fresh part of the boulder and of two samples of the lateritic part showed that the diabase weathered directly into

uminum hydrate and iron oxides without any indication of the intermediate ·rmation of kaolin.

3. Formation of a laterite from a practically quartz-free diabase—Pt. II, Microscopical evidence: Geol. Mag., decade 5, v. 8, no. 8, p. 353–356, and Correspondence, v. 8, no. 11, p. 477–478, 1911.

Under low magnification the thin sections through the inner and outer crusts ' laterite clearly show diabase structure. Augite is replaced by reticulated inter- ›cting lines and streaks of limonite; feldspar areas are outlined by films of limonite s are the former cleavages and lines of chemical weakness. The spaces between ıe limonite films are completely filled with masses or aggregates of very minute :ales of gibbsite. Only ilmenite is unaltered. A few small blebs of quartz milar to those in the diabase also occur in the laterite.

4. Reports and correspondence relative to bauxite in British Guiana, 1910 to 1917: 17 p., Georgetown [Demerara], British Guîana Combined Court, 1916; repr., 31 p., Georgetown, "The Argosy" Co., Ltd., 1917.

5. The katamorphism of igneous rocks under humid tropical conditions; 79 p., Harpenden [England], Imp. Bur. Soil Sci., Rothamsted Exper. Sta., 1934.

The term laterite is used to denote the product of the weathering of basic or ıtermediate rocks in place; it is characterized by concretionary masses at the ɔp composed largely of iron and aluminum hydrates together with some secondary uartz. On the basis of composition, laterites are classified as ferruginous lat- rites, lateritic ironstone, concretionary ironstone, quartziferous or siliceous ıterite, or gibbsitic or bauxitic laterite. Weathering products consisting largely f secondary aluminum silicates are called lateritic earth or argillaceous laterite; ·here it forms relatively hard masses, it is called lithomarge.

The katamorphism of basic, intermediate, and acid igneous rocks are treated eparately, the first in most detail. The differences in high- and low-level laterites erived from basic igneous rocks are considered to be due not only to variations ı the amounts and distribution of rainfall, but also to drainage conditions, with he result that the high-level laterites are predominantly hydrous iron and alu- ninum oxides, and the low-level are secondary aluminum silicates and secondary ıuartz. Rainfall statistics are given for the areas studied.

The author presents the following conclusions: (1) Under both tropical and emperate conditions, surficial weathering of igneous rocks results in katamor- ›hism by the process of hydration and oxidation. The end product consists of ilicates of aluminum or silico-aluminic acids, hydrated silicates of iron, and hydrated ›xides of iron, together with residual quartz and other resistant minerals. (2) Jnder tropical conditions, the katamorphism of basic or intermediate igneous ·ocks at, or close to, the water table, and under conditions of more or less perfect lrainage, results in the nearly complete removal of silica, and calcium, magne- ;ium, potassium and sodium oxides, leaving an earthy residuum consisting of $Al_2O_3$, limonite, some unaltered feldspar, secondary quartz, and resistant min- ›rals. This is termed primary laterite. (3) The process of primary laterization s succeeded by resilication, which results in lateritic earths or argillaceous later- te. (4) Under exceptional conditions, deposits of secondary quartz occur in ›lace of lateritic earth. (5) Under tropical conditions, acidic rocks do not un- lergo primary laterization, but are altered to pipe or pot clays, or more or less mpure kaolin. (6) Under tropical conditions, lateritic earths and pot clays may ındergo desilication, with the formation of concretionary and surficial masses of ɔauxite. (7) Under temperate conditions, katamorphism of basic rocks is not a ateritic action, but is a less complete degradation and decomposition accom- ɔanied by oxidation, hydration, and leaching, by which hydrated silicates are ormed. (8) The difference in katamorphism of basic rocks, in the tropics and

in temperate regions, shows why the former results in the formation of soils of low fertility, and the latter, of fertile soils.

This paper, published posthumously, is one of the most important in the study of rock weathering.

**Hayes, C. Willard.**

1. Bauxite: U. S. Geol. Survey Min. Res. U. S., 1893, p. 159–167, 1894.

The known bauxite deposits of the United States occur in the southern Appalachians and lie along a narrow strip about 60 miles long, extending from Adairsville, Ga. southwestward to Jacksonville, Ala. The deposits are pockets of generally pisolitic ore surrounded by clay and are associated with faults cutting the Knox dolomite.

2. Bauxite, its occurrence, geology, origin, and economic value: U. S. Geol. Survey 16th Ann. Rept., pt. 3, p. 547–597, 4 pls., 9 figs. [incl. geol. map], 1895.

A description of the known occurrences of bauxite throughout the world constitutes an introduction. The geology and bauxite deposits of Appalachian Alabama and Georgia are described in detail. Location of the known deposits is shown on a geologic map of the area. The deposits are closely related to the topography, occurring at about the same altitudes, and to the stratigraphy and structure. Bauxite is classified as pebble, pisolitic, oolitic, vesicular, and amorphous ores. Microscopic studies and chemical analyses indicate that the most important mineral constituents are gibbsite, halloysite, and kaolin. The deposits are considered to have been formed in the following manner: surface water penetrating downward through faults, reacted with iron sulfides in shale underlying the Knox dolomite; the $H_2SO_4$, thus formed, dissolved out alumina from the shale, forming aluminum sulfates, or, in the presence of an excess of potash the double sulfate of potassium and aluminum; when waters bearing these salts in solution ascended through the limestone to the surface, lime was also taken into solution, thus causing the precipitation of $Al_2O_3$; then, as in areas of springs and geysers, the precipitated gelatinous alumina was carried upward "by the water and at the same time compacted into the concretions of various sizes which characterize the bauxite".

3. The geological relations of the southern Appalachian bauxite deposits: Am. Inst. Min. Eng. Trans., v. 24, p. 243–254, 4 figs., 1895.

The bauxite deposits are irregularly distributed in a narrow belt extending from Adairsville, Ga. southwestward 60 miles to Jacksonville, Ala. and, at least in the Rock Run district, appear to lie along faults in the Knox dolomite. It is suggested that the deposits are due to the action of hot waters on shale at depth and the precipitation of bauxite at the surface by ascending waters.

4. The Arkansas bauxite deposits: U. S. Geol. Survey 21st Ann. Rept., pt. 3, p. 435–472, 5 pls., 1901.

The paper includes a discussion of the general geologic and physiographic history of the area. The late Cretaceous syenite intrusive rocks, Tertiary sediments, and bauxite deposits of the bauxite districts are described in detail. Reserves are given by sections for the Bryant district, Saline County. The origin of the deposits is tentatively ascribed to the action of heated alkaline waters on the syenite, dissolving out the silica and the bases, and leaving the alumina to form the residual granitic bauxite. It is suggested that pisolitic bauxite was formed from a gelatinous precipitate on the sea floor and that it overlies either bauxite of the granitic type or Tertiary clays. The quality and grade of the ore and mining methods are discussed.

5. Description of the Rome quadrangle, Ga.-Ala.: U. S. Geol. Survey Geol. Atlas, folio 78, 6 p., 4 maps, 1902.

The bauxite deposits in the vicinity of Rome, Georgia, are probably of Neocene age. The ore is considered to be due to the action of sulfuric acid-bearing waters which attacked aluminum silicate of the Conasanga shales to form free silica and aluminum sulfate. The latter was brought to the surface along fractures and, upon coming in contact with the limestones at the surface, precipitated aluminum hydroxide which subsequently segregated into pisolites. The location of all known deposits in the area is shown on the Economic Geology sheet in the folio.

6. The Gila River alum deposit: U. S. Geol. Survey Bull. 315, p. 215–223, 1 fig., 1907.

Although it had previously been reported as bauxite, analyses show the alum rock in Grant County, N. Mex., to be an aluminum silicate similar to kaolin. The material appears to have broken through the basalt, forming a plug. The alum is so thoroughly altered that none of the original rock was found.

**Heiland, C. A.**

Geophysics in war: Colo. School Mines Quart., v. 37, no. 1, 85 p., 37 figs., 1942; Mines Mag. [Colo. School Mines], v. 32, no. 2, p. 65–70, 86, 1942; Compass, v. 23, no. 2, p. 163–168, 1943; abs., Am. Assoc. Petroleum Geologists Bull., v. 26, no. 3, p. 903, 1942.

The use of geophysical methods in the discovery and exploration of many types of mineral deposits is the main subject of this paper; a short section is an outline of the geophysical methods applicable to the discovery of new deposits of bauxite in Arkansas.

**Henatsch, W.**

Über Bauxite und ihre Verarbeitung: 29 p., Breslau, 1879.

**Hendricks, Sterling B.** (*See also* Alexander, L. T.).

(and Goldich, Samuel S., and Nelson, Reuben A. A portable differential thermal analysis unit for bauxite exploration: Econ. Geology, v. 41, no. 1, p. 64–76, 8 figs. 1946; abs., v. 40, no. 8, p. 594, 1945; Geol. Soc. America Bull., v. 56, no. 12, pt. 2, p. 1166, 1945; Am. Mineralogist, v. 31, nos. 3–4, p. 198, 1946.

A newly designed portable thermal analysis unit is described, and the wiring diagram figured. The unit was designed for field exploration for bauxite and was so used in Hispaniola. Curves showing the results of analysis of lateritic soils, gibbsite, boehmite, clays, and related minerals are shown, together with several curves made on a laboratory model for comparison. Two methods of quantitative analysis are shown to be feasible—measuring the area under the curve, and measuring the maximum deflection; gibbsite can be determined with an accuracy of 10 percent.

**Hendryx, H. E.** *See* Allen, Niel R.

**Hernandez Sampelayo, Primitivo.** *See* Sampelayo, Primitivo Hernandez.

**Herring, C. T.** *See* Franke, Herbert A.; *and* Miller, R. B.

**Hilgard, Eugene W.**

Report on the geology and agriculture of the State of Mississippi: 391 p., 2 pls., 6 figs., Jackson, Miss., 1860.

*Page 14:* A rock outcropping in Tippah and Benton Counties is described and

called a puddingstone. Although the author apparently did not recognize this rock as bauxite, it was subsequently recognized as such and is, therefore, the first published description of bauxite in the United States.

**Hill, James M.**

1. Bauxite and aluminum: U. S. Geol. Survey Min. Res. U. S., 1916, pt. 1, p. 159–170, 1917.

Statistics on domestic and world production and consumption of bauxite and aluminum include 1916 and previous years. The location of the known commercial bauxite deposits in the United States, the geologic setting, and the character of the ore are summarized. The mining companies and the areas in which they operated are discussed by States.

2. Bauxite and aluminum: U. S. Geol. Survey Min. Res. U. S., 1917, pt. 1, p. 1–9, 1918.

Statistics on domestic and world production and consumption of bauxite and aluminum include 1917 and previous years. Twenty-four companies in the United States are listed as consumers of bauxite. The mining companies and the areas in which they operated are discussed by States.

3. Bauxite and aluminum: U. S. Geol. Survey Bull. 666, p. 85–88, 1919.

The consumption of bauxite in the United States amounted to more than 400,000 tons in 1916. The largest part of the output came from Arkansas with the northern Alabama-Georgia deposits second. The increased consumption is due to the growth of the aluminum industry and new uses for bauxite. Uses, production, and consumption statistics for the years from 1905 through 1916 are given. Mining areas in the country are briefly described.

4. Bauxite and aluminum: U. S. Geol. Survey Min. Res. U. S., 1918, pt. 1, p. 513–526, 1 pl., 1920.

Statistics on domestic and world production and consumption of bauxite and aluminum include 1918 and previous years. The location of bauxite deposits and of works manufacturing bauxite products is shown on an index map, accompanied by a discussion, by States, of the mining companies and the areas in which they operated.

5. Bauxite and aluminum: U. S. Geol. Survey Min. Res. U. S., 1919, pt. 1, p. 33–40, 1920.

Statistics on domestic and world production and consumption of bauxite and aluminum include 1919 and previous years. The mining companies and the areas in which they operated are discussed by States. All bauxite used in the production of aluminum during the year came from Arkansas. The foreign deposits mentioned are those of India, Africa, and British Guiana.

6. Bauxite and aluminum: U. S. Geol. Survey Min. Res. U. S., 1920, pt. 1, p. 29–36, 1921.

Statistics on domestic and world production and consumption of bauxite and aluminum include 1920 and previous years. The mining companies and the areas in which they operated are discussed by States, with a brief description of the mining methods in Arkansas. Mining operations in British and Dutch Guiana, Italy, and France are mentioned.

7. Bauxite and aluminum: U. S. Geol. Survey Min. Res. U. S., 1921, pt. 1, p. 63–70, 1922.

Statistics on domestic and world production and consumption of bauxite and aluminum include 1921 and previous years. New discoveries in foreign countries are described briefly. Mining companies and the areas in which they operated are discussed by States.

8. Bauxite and aluminum: U. S. Geol. Survey Min. Res. U. S., 1922, pt. 1, p. 87–96, 1923.

Statistics on domestic and world production and consumption of bauxite and aminum include 1922 and previous years. The mining companies and the eas in which they operated are discussed by States. Bauxite was mined during e year by four companies in Arkansas, and by several in Georgia, Alabama, d Tennessee. No bauxite was mined in Mississippi. The possible competi- on of the diaspore deposits of Missouri and the alunite deposits of Utah is nsidered unimportant.

9. The marketing of bauxite: Eng. Min. Jour., v. 115, no. 8, p. 800–802, 1 fig., 1923.

Production and consumption figures for the United States, 1912–22, and world oduction by countries, 1913 and 1916–21, are included. Domestic consumers e listed. The grade of bauxite preferred by the chemical, abrasive, metal, and fractory industries is given.

10. Bauxite and aluminum: U. S. Geol. Survey Min. Res. U. S., 1923, pt. 1, p. 23–34, 1924.

Statistics on domestic and world production and consumption of bauxite and uminum include 1923 and previous years. The mining companies and the eas in which they operated are discussed by States. A short section entitled New bauxite field in northeastern Mississippi" was contributed by E. F. Burchard.

11. Bauxite and aluminum: U. S. Geol. Survey Min. Res. U. S., 1924, pt. 1, p. 21–29, 1925.

Statistics on domestic and world production and consumption of bauxite and uminum include 1924 and past years. The mining companies and the areas which they operated are discussed by States. Domestic production decreased 1 percent from that in 1923, but imports increased 70 percent.

12. Bauxite and aluminum: U. S. Bur. Mines Min. Res. U. S., 1925, pt. 1, p. 17–29, 1928.

Statistics on domestic and world production of bauxite and aluminum include 925 and previous years. The mining companies and the aeras in which they perated are discussed by States. Almost all of the domestic production was om Arkansas. Total production decreased 9 percent from 1924, but imports icreased 75 percent in the same interval.

13. Bauxite and Aluminum: U. S. Bur. Mines Min. Res. U. S., 1926, pt. 1, p. 51–65, 1929.

Statistics on domestic and world production of bauxite and aluminum include 926 and previous years. The mining companies and the areas in which they perated are discussed by States. The domestic output increased 24 percent ver that in 1925, but imports decreased 20 percent in the same interval.

14. Bauxite and aluminum: U. S. Bur. Mines Min. Res. U. S. 1927, pt. 1, p. 7–24, 1930.

Statistics on domestic and world production of bauxite and aluminum include 927 and previous years. The mining companies and the areas in which they perated are discussed by States. The bauxite deposits of Africa, British Guiana, Dutch Guiana, France, Germany, Hungary, India, Poland, and Yugoslavia are riefly described. Several new processes for the beneficiation of low-grade mate- ial have been studied during the year.

**Iills, E. S.** *See* Raggatt, H. G.

**Hocart, Raymond.** *See also* Lapparent, Jacques de.

(and Lapparent, Jacques de.) Sur la boehmite des bauxites: Acad. sci. Par Comptes rendus, tome 189, p. 995–996, 1929 [French].

X-ray studies of boehmite, diaspore, lepidocrosite, and goethite confirm th work of Böhm and show that boehmite is a new species and the homolog c lepidocrosite, as diaspore is the homolog of goethite.

**Hoffmann, Fritz.**

Einiges über die Bauxitvorkommen Sowjet-Russlands: Metall u. Erz, 35 Jahrg Heft 13, p. 339–342, 3 figs., 1938 [German].

Exploration for domestic sources of bauxite to supply the aluminum industr had delimited three districts by 1938: Tikhvin, 230 km east of Leningrad Kuschwa in the middle Urals, east of Perm and northwest of Tagil; and Alapaevsk also in the middle Urals, but southeast of Kuschwa. Limestone of Cretaceous ag is present in all three districts. The Tikhvin bauxite averages 45 percent alumina 15 percent silica, 4–24 percent iron oxide, and 15 percent water. The Kuschw ore is of commercial grade, but that at Alapaevsk is inferior. The developmen of the Russian aluminum industry includes three plants, for which domestic or is desired in addition to that used in the manufacture of corundum and aluminou cements.

**Holland, Sir Thomas H.**

1. On the constitution, origin, and dehydration of laterite: Geol. Mag., decad 4, v. 10, no. 2, p. 59–69, Feb. 1903.

The author agrees with Max Bauer in saying that laterite and bauxite ar chemically the same; that the alumina is largely gibbsite; but that some lowe hydrate, probably diaspore, is also present. It is suggested, however, that th formation of laterite is due to the action of "some lowly organism" in taking u silica from silicates and releasing it in soluble form so that it is removed durin the wet season. The occurrence of laterite may be controlled by the climate which this organism can tolerate. Formation of kaolin is thought to be due t deep-seated, high-temperature conditions. Dehydration and formation of con cretionary structures is here related to the heat of formation of crystals.

2. The occurrence of bauxite in India: India Geol. Survey Rec., v. 32, pt. 2 p. 175–184, 1905.

Chemical analyses of high-grade laterites of India show them to be similar i composition to bauxite. Inasmuch as it is not possible to export this material a a profit because of high freight rates, it is suggested that the laterite be converte to alumina within the country and then exported.

**Holmes, Arthur.**

The lateritic deposits of Mozambique: Geol. Mag., decade VI, v. 1, no. 12 p. 529–537, 2 figs., 1 pl., London, 1914.

In similar granites it is noted that the feldspar will in one place have broke down into kaolin, and in another, into aluminum hydroxides. Certain condition may be correlated with these processes: the formation of kaolin seems to be con ditioned by heavy vegetation, and that of bauxite by the absence of vegetatio and of humus, and by the presence of sulfides.

**Horton, Frederick W.**

Bauxite: The Mineral Industry, 1909, v. 18, p. 67–72, 1910.

Statistics on domestic production by States, imports, exports, and consumptio

nclude the years 1899 to 1909. Producing mines and operating companies re given by States. Bauxite deposits in Austria, France, Hungary, India, taly, and Ireland are briefly described.

**Iorvath, Béla de.**

Sur la composition chimique de bauxites du comitat de Bihar: Magyar földt. társulat Földt. közlöny, kötet 41, p. 254–257, 341–343, Budapest, 1911 [Hungarian and French].

The percentages of silica and alumina were determined for 16 samples of auxite from the Bihar Mountains, Rumania. Whole analyses were made for hree others. The minerals distinguished were diaspore, gibbsite, corundum, nagnetite, hematite, goethite, limonite, ilmenite, quartz chlorite, and white nica.

**Iose, H. R.**

The geology and mineral resources of Jamaica: Colonial Geology and Min. Res., v. 1, no. 1, p. 11–36, 3 maps, 4 pls., London, 1950.

The sedimentary rocks of Jamaica, British West Indies, range from conglomer-te, shale, and sandstone of the lower Cretaceous to coral reef and alluvium of the Recent. The mineral resources include gold, silver, bauxite, copper, lead and inc, iron, manganese, cobalt, mineral fuels, phosphate, gypsum, and limestone. The section on bauxite covers the discovery in the parishes of St. Ann, Manchester, nd St. Elizabeth. The bauxite is soft, earthy, dark red or yellow-brown. It s a mixture of cryptocrystalline aluminum trihydrate, hydrated and unhydrated ron oxides, and alumina-iron gels. The deposits occupy sinkholes in the uneven urface of the White Limestone formation of early Tertiary age. A spot map, cale about 10 miles to the inch, shows the location of all known mineral deposits. The geology of the island is shown on another map of the same scale.

**Howe, Raymond M.**

(and Ferguson, R. F.). Composition and properties of diaspore, bauxite and gibbsite: Am. Ceramic Soc. Jour., v. 6, p. 496–500, 1923.

The uses of bauxite, diaspore, and gibbsite as refractory materials are discussed: Chemical analyses, fusion points, burning shrinkage at various temperatures, nd porosity and volume changes for a number of samples are given.

**Hsieh, C. Y.** *See also* Li, Chingyuan Y.

1. A microscopical study of the bauxite deposit in the Tzechuan-Pashan district, Central Shantung: China Geol. Survey Bull. 25, p. 55–62, 3 pls., Peking, 1935 [English, Chinese summary].

Microscopic study indicates that the bauxite-shale beds of the district consist of kaolinite, diaspore, and a brownish-yellow amorphous material which forms he bulk of the material. The deposits are very large but have a silica content etween 21 and 43 percent, and this is present, at least partly, as kaolinite. The origin of the deposits is discussed.

2. Origin of the Chinese bauxite deposits: China Mineral Expl. Bur. Contr. Econ. Geology, no. 2, p. 37–54, 3 pls., Kweiyang, 1944 [English].

In China, bauxite occurs in six fields: in central Kueichou and central Yunnan, t is Carboniferous in age, and high-grade ore occurs in beds 2–3 meters thick and verages 70 percent alumina; in central Shantung, southern Szechuan, and south-ern Liaoning, it is both late Permian and Triassic in age, is 2–4 meters and 20 neters thick, respectively, and averages 50–59 percent alumina and 20–40 percent silica; in southern Fuchien, it is Quaternary to Recent in age, irregularly distrib-

uted, and averages 69 percent alumina with a high iron content. The Yunnan-Kueichou deposits are considered to be Terra-rossa washed into a shallow Carboniferous sea. They are 10–15 meters thick. Of this, the upper 6 feet is low-to medium-grade ore, dense and compact, showing conchoidal fracture, and containing flat, disc-like concretions of kaolinite. The middle 2–3 meters is the ore, white to gray, porous, with partings or lenses of oolitic, pisolitic, and brecciated ore. The lower 2–8 meters is a low-grade, "flint-shale-like ore with many kaolinite concretions." The iron is concentrated in the base of the deposits. Under the microscope the low-grade material is seen to be largely kaolinite with some eliachite (amorphous material); the high-grade ore is almost exclusively subcrystalline aggregates of an aluminum monohydrate, probably diaspore. It is believed that the high-grade ore is to be attributed to secondary enrichment, by which colloidal alumina was leached down and deposited either near or just below the top of the ground-water table. This process was facilitated by humic acid in the water. The low-grade materials above and below are, then, due to the process of resilication, which became important after the deposition of the overlying limestones and subsequent uplift. The downward-circulating alkaline waters dissolved silica from the impure limestone. If the ground-water level was at the upper part of the bauxite beds, the colloidal silica would combine with the alumina, thus forming the kaolinite which now constitutes the low-grade material. Static and dynamic metamorphism caused dehydration and recrystallization.

**Humbert, R. P.**

The genesis of laterite: Soil Sci., v. 65, no. 4, p. 281–290, 1948.

This paper gives the results of a field and laboratory study of laterite in British New Guinea. The emphasis is on the formation and occurrence of "iron crusts". Laterite is considered to form under conditions of abundant moisture and high temperature, as in humid equatorial regions. In the final stage of laterization, a horizon develops in which the oxides of iron are concentrated. The horizon becomes indurated on exposure. "Laterite" is taken as the material originally described by Buchanan and defined as "iron-oxide-rich, indurated, quarryable slag-like or pisolitic illuvial horizon developed in the soil profile".

**Hunt, Alfred E.**

1. Aluminum: U. S. Geol. Survey Min. Res. U. S., 1892, p. 227–257, 1893.

The history and development of processes for the commercial production of aluminum from bauxite are traced. Results of tests showing the physical properties of aluminum are given in detail. Statistics on production and consumption are included.

2. Bauxite: Am. Inst. Min. Eng. Trans., v. 24, p. 855–861, 1895.

This is a discussion of the papers of F. Laur and C. W. Hayes in the same volume, p. 234–242 and 243–252. Additional chemical analyses are presented.

**Hutchinson, G. Evelyn.**

(and Woblack, Anne). Biological accumulators of aluminum: Conn. Acad. Arts Sci. Trans., v. 35, p. 73–128, 1943.

A detailed study shows the aluminum that is accumulated by some plants, especially the genus *Lycopodium.* A modification of the usual method for determination of aluminum was devised.

**Hüttig, G. F.**

(and Wittgenstein, E. v.). Zur Kenntnis des Systems Aluminiumoxid-Wasser: Zeitschr. anorg. allg. Chemie, Band 171, p. 323–343, 1928 [German].

**Ijzerman, R.**

Outline of the geology and petrology of Surinam (Dutch Guiana): 519 p., 48 pls., 6 maps, The Hague, Martinus Nijhoff, 1931 [English].

*Bauxite, pages 9–10.*—Bauxite is the most important mining industry in Surinam. The largest deposits occur near Moengo on the upper Cottica River; along the Para River; near Rorac on the Suriname River; and in the interior, near Browns Mountain and in the Nassau Mountains.

*The laterites, pages 63–75.*—Lateritic weathering processes are discussed. Two kinds of laterite occur in Surinam: ferruginous laterite concentrates, and aluminous laterite concentates (bauxite). Of the latter, there are: (1) the lowland type which occurs on flat-topped hills, from a few to 35 meters above sea level; and (2) the type that occurs on flat-topped hills or plateaus inland and at higher elevations, as on the Brownsberg [Browns Mountain?], 140 meters in elevation, and in the Nassau Mountains. The deposits do not exceed 8 feet in thickness, and generally overlie kaolin. The rock or rocks from which the bauxite was derived is unknown. The age of the deposits has not been determined, but it is considered "not improbable that the formation of the bauxite began before the * * * Pleistocene."

The residue obtained from dissolving bauxite in concentrated $H_2SO_4$ showed a variety of accessory minerals: abundant zircon and leucoxene; variable amounts of staurolite, toumaline, and quartz; and, rarely, rutile, muscovite, chloritoid, titanite, and kyanite.

**Il'ina, N. S. (Iljina, Ilyina).** *See also* Terenteva, K. F.

Geologiya, mineralogiya i genezis boksitov Buksonskogo mestorozhdeniya v vostochnom Sayane (The geology, mineralogy, and origin of the bauxites of the Buksonsky deposit in the eastern Sayan Range): Akad. nauk SSSR Izv., Ser. geol., no. 1, p. 83–89, Moscow, 1944 [Russian, English summary].

The bauxite deposits in the eastern Sayan Range, U.S.S.R., lie on an uneven surface of algal reefs of Cambrian age. The deposits are 25–30 meters thick, and are in most places dark red in color, but in some places greenish. A mineralogic study indicates that the deposits are largely cryptocrystalline diaspore or boehmite and hematite. It is suggested that deposition of the bauxite, together with a considerable quantity of clastic material, took place in a shallow sea.

**Ivanov, B. A.**

Boksity Vostochnykh Sayan [Bauxites of the eastern Sayan Mountains]: Razvedka Nedr, v. 13, no. 3, 3 figs., p. 9–12, Moscow, 1947 [Russian].

**Jakšić, Tihomir.**

Boksiti u Hercegovini, a specialno u okolini Mostara: Inst. géol. Zagreb Bull., tome 2, p. 82–118, 8 figs., Zagreb, 1928 [Yugoslavian, French summary].

In a zone trending southeastward from the central part of the Herzegovina karst to the Dalmatian border, a number of bauxite deposits are known to occur. Those in the vicinity of Mostar are yellow to red, pisolitic, and on an average contain about 1.5–3.0 percent silica. They overlie Upper Cretaceous limestones.

**James, W. T.** *See also* Junner, N. R.

The mineral resources of the Gold Coast: Min. Jour., Centenary Number, p. 117–118, London, 1935.

The important mineral resources of the Gold Coast, Africa, are gold, manganese, diamonds, bauxite, oil, iron, chromite, and tin. The bauxite present may amount to hundreds of millions of tons.

**Jannettaz, E.**

1. La composition chimique de matières envoyées de la Guyane française à l'exposition permanente des Colonies comme argiles ou comme minerais de fer: Soc. géol. France Bull., tome 6, 3e sér., p. 392, 1877–78 [French].

The composition of two types of material from Boulanger Bay, French Guiana, is presented in a brief communication. One sample is largely hydrargillite, with 7–8 percent of iron oxide; the other is pisolitic and is predominantly iron oxide, with 15–20 percent of alumina.

2. Gibbsite et bauxite de la Guyane française: Soc. Française minéralogie Bull., tome 1, pl 70–71, 1878 [French].

Three types of altered rock from French Guiana are described. The first is composed of irregular spheres. Chemical analysis showed 33.5 percent water, 64.4 percent alumina, 1.5 percent peroxide of iron; this indicates a substance which is almost entirely gibbsite. The second sample is compact. Chemical analysis showed 29.2 percent water, 63.3 percent alumina, and 7.5 percent peroxide of iron; the analysis indicates a mixture of gibbsite and limonite. The third sample is pisolitic. It analyzed 19.65 percent water, 67.84 percent peroxide of iron, 12.11 percent alumina and consists, therefore, largely of hydrous iron oxide.

**Jaquet, John B.**

1. Discovery of bauxite at Wingello [Australia]: New South Wales Dept. Mines and Agriculture, Ann. Min. Rept., 1899, p. 187–188, 1 map, 1900.

In a geologic examination of the iron ores near Wingello, New South Wales, samples were taken of the surficial deposits of brown, pisolitic iron ore. A partial chemical analysis shows 25.09 percent iron, 3.05 percent sulfate, 6.00 percent gangue, and 22.00 percent water. The remainder, about 43 percent, is alumina. This article records the first discovery of bauxite in Australia.

2. The iron-ore deposits of New South Wales [Australia]: New South Wales, Geol. Survey Mem., Geology, no. 2, 186 p., 28 pls., 4 maps, 1901.

*The aluminum iron-ores and bauxites of Wingello, p. 85–105.*—The bauxite deposits of the world are described briefly by countries, with special emphasis on those of France, Ireland, and the United States. The history of the discovery of bauxite in New South Wales shows that it was considered to be a pisolitic ironstone. The deposits at Wingello and Inverell occur as beds 10–20(?) feet thick on low, flat-topped hills underlain by Tertiary beds. The ore is bright red, pisolitic, with an earthy matrix. Chemical analyses indicate a high silica content, but much of this is probably present as sand. It is postulated that the deposits were formed in shallow lakes or rivers in Tertiary time, essentially from products derived from basalt. The bauxite and aluminous iron-ore deposits are shown on a map of the Wingello area, scale 2 inches to the mile.

**Jones, Neal K.** *See* Carroll, Dorothy.

**Jones, Walter B.**

1. Bauxite in Alabama, with a special discussion of the Margerum district: Econ. Geol., v. 21, no. 8, p. 792–802, 2 figs., 1926.

The geology and location of deposits are given briefly for the three bauxite areas in the State. Bauxite occurs along the contacts between (1) formations of

Cambrian and Ordovician age in northeastern Alabama; (2) the Midway and Nanafalia formations in Barbour and Henry Counties; and (3) formations of Cretaceous and Mississippian age near Margerum in Colbert County. Theories of origin of bauxite are discussed, and it is noted that ". . . everywhere it appears to form through erosional or weathering agencies."

2. Index to the mineral resources of Alabama: Ala. Geol. Survey, Bull. 28, 250 p., 42 pls., 15 figs. (incl. sketch maps), 1926.

*Bauxite, p. 24–37.*—The deposits throughout the State are briefly described. Open pit mining has been used exclusively. It is noted that all the bauxite deposits in Alabama occur along erosional unconformities and in pockets in limestones; however, the role of the limestone may have been no more than the supplying of carbonic waters which may have aided in precipitating both alumina and iron.

3. Summary report on the bauxite deposits of Alabama: Ala. Geol. Survey Circ. 7, 36 p., 2 figs., 3 pls., 1929.

The bauxite deposits of Alabama are shown to fall into three groups. The first are those along the contact between formations of Cambian and Ordorician age in the eastern part of the Coosa Valley, northeastern Alabama. Here most of the deposits occur near the top of the Conasauga formation (Cambrian), but a few occur in the Shady limestone and the Chepultepec and Copper Ridge dolomites (Cambrian and Ordovician). Mining began soon after the discovery of bauxite here in 1889 and continued until after World War I. The second group are those along the Midway-Wilcox contact (Eocene) in Barbour and Henry Counties. Bauxite occurs in erosion channels near the top of the Clayton limestone (Midway group) and as lenses in the Nanafalia formation (Wilcox group). Mining began in 1927. The third group are those at the Mississippian-Tuscaloosa contact near Margerum, Colbert County. Here Mississippian formations are overlain by Cretaceous (Tuscaloosa) clays and gravel in which the bauxite occurs as pockets. The area has never been mined. Deposits in each group are described by Counties and located by sections and ¼ sections.

4. Bauxite mining in the United States—Alabama: Mining and Metallurgy, v. 15, no. 336, p. 481–482, 2 figs., 1934.

Only bauxite deposits of Barbour and Henry Counties were mined in Alabama in 1934. Open-pit mining is used exclusively. The deposits are first stripped with a slip scoop, and when the ore body is uncovered, it is mined with pick and shovel and loaded by hand into wagons or trucks. Steam shovels are never used.

5. Bauxite deposits of Alabama: Ala. Geol. Survey, Bull. 47, 94 p., 42 figs. (incl. index map), 1940.

Bauxite is classified according to texture as boulder, pebble, buckshot, oolitic, compact, and earthy. The bauxite deposits of Alabama occur in three separate regions which show characteristic geologic conditions: (1) along contacts between formations of Cambrian and Ordovician age in the northeastern part of the State; (2) the Midway group and Nanafalia formation in Barbour and Henry Counties; and (3) formations of Cretaceous and Mississippian age near Margerum, Colbert County. Outcrops, mines, pits, and buried deposits for all three regions are described in detail and precisely located.

**Joraleman, Ira B.**

Our mineral reserve: Mines Mag., v. 35, no. 3, p. 114–117, 141, Golden, Colo., 1945.

Although high-grade bauxite occurs in the United States in only small quantities, there are vast tonnages of material containing 25 to 35 percent $Al_2O_3$. This percentage would be high-grade ore in any other metal of comparable price; the development of an economical process for the recovery of alumina from anorthosite, high-alumina clay, and alunite would make the material available for use.

**Judd, Edward K.**

1. Bauxite: Mineral Industry, 1906, v. 15, p. 75–80, 1907.

Statistics on domestic production by States, imports, exports, and consumption of bauxite include the years 1896 to 1906. Producing mines and the operating companies are given by districts. Mining methods at two mines in the Hermitage, Ga. district are briefly described.

2. The bauxite industry in the South: Eng. Min. Jour., v. 83, p. 574–575, 1907.

The Georgia-Alabama district described lies along the Coosa Valley extending from Adairsville, Ga., to Jacksonville, Ala. The deposits are somewhat funnel-shaped, tapering from about 200 to 500 feet in diameter at the surface to less than 100 or 75 feet in depth. The walls of the deposits are lined with boulders and gravel, and clay surrounds the bauxite. In 1907, mining was restricted to three areas: Hermitage, Ga., Cave Spring, Ga., and Rock Run, Ala. Mining methods, operating companies, and bauxite drying methods are described. The area is [1907] the leading producer of chemical grade bauxite in the country.

3. Bauxite: Mineral Industry, 1907, v. 16, p. 97–102, 1908.

Statistics on domestic production by States, imports, exports, and consumption include the years 1887 to 1907. The bauxite deposits of Georgia and Alabama are briefly described. Deposits in Austria, India, and Ireland are mentioned. A short section shows the progress in the technology of bauxite.

**Julihn, C. E.**

1. Bauxite and aluminum: U. S. Bur. Mines Min. Res. U. S., 1929, pt. 1, p. 485–506, 1931.

Statistics on domestic and world production and consumption include the current and previous years. The production and uses of domestic and imported bauxite are discussed. A section on foreign bauxite and aluminum industries shows production figures, operating companies, types and locations of installations, areas mined, some chemical analyses, or information on grade of ore. This section, here and in the following issues of the Minerals Yearbook is a comprehensive résumé of the industry throughout the world.

2. Bauxite and aluminum: U. S. Bur. Mines Min. Res. U. S., 1930, pt. 1, p. 151–178, 1931.

Statistics on domestic and world production and consumption of bauxite include the current and previous years. The production and uses of domestic and imported bauxite are discussed briefly. A section on foreign bauxite and aluminum industries shows production, operating companies, types and location of installations, areas mined, some chemical analyses, or information on grade of ore. A résumé of the domestic bauxite industry by States gives the mining companies and the areas in which they operated. Domestic production decreased 10 percent during 1930.

3. Bauxite and aluminum: U. S. Bur. Mines Min. Res. U. S., 1931, pt. 1, p. 17–41, 1932.

Statistics on domestic and world production and consumption include the current and previous years. The production and uses of domestic and imported

bauxite are discussed. A section on foreign bauxite and aluminum industries shows production figures, operating companies, types and locations of installations, areas mined, some chemical analyses, or information on grade of ore. The names of the producers and consumers of bauxite in the United States are listed. World production of bauxite decreased 17 percent in 1931, but output of aluminum in the same year reached a new maximum.

4. Bauxite and aluminum: U. S. Bur. Mines Minerals Yearbook, 1932–33, p. 207–224, 2 figs., 1933.

Statistics on domestic and world production and consumption include the current and previous years. The production and uses of domestic and imported bauxite are discussed. A section on foreign bauxite and aluminum industries shows production figures, operating companies, types and locations of installations areas mined, some chemical analyses, or information on grade of ore. The names of the producers and consumers of bauxite in the United States are listed. Production of bauxite and aluminum are shown on graphs. The decline in domestic bauxite production during the year amounted to about 51 percent of the 1931 production.

5. Bauxite and aluminum: U. S. Bur. Mines Minerals Yearbook, 1934, p. 367–384, 2 figs., 1934.

Statistics on domestic and world production and consumption include the current and previous years. A section on foreign bauxite and aluminum industries shows production figures, operating companies, types and locations of installations, areas mined, some chemical analyses, or information on grade of ore. The names of the producers and consumers of bauxite in the United States are listed. Production of bauxite and aluminum are shown on graphs. World production of bauxite increased slightly during the year, although production of aluminum declined. Of domestic production, 92 percent came from 4 mines in Arkansas; the remainder was from Alabama and Georgia and was all used in the chemical industry.

6. Bauxite and aluminum: U. S. Bur. Mines Minerals Yearbook, 1935, p. 419–435, 1935.

Statistics on domestic and world production and consumption include the current and previous years. A section of foreign bauxite and aluminum industries shows production figures, operating companies, types and locations of installations, areas mined, some chemical analyses, or information on grade of ore. The names of the producers and consumers of bauxite in the United States are listed. Production of bauxite and aluminum are shown on graphs. World production of both bauxite and aluminum increased moderately during the year. Most of the domestic production was from 7 mines in Arkansas which produced 92 percent of the total; 8 percent was mined in Alabama and Georgia, and all of it was used in the chemical industry.

**Junker, H. W.**

Bauxit und Laterit auf Banka: Ingenieur in Nederlandsch-Indië—IV Mijnbouw en geologie, Jahrg. 3, no. 2, p. 15–23, 1 fig., Feb. 1936 [Dutch]; abs., Neues Jahrbuch, Referate II, Band 5, p. 629, 1936 [German].

On the Island of Banka, bauxite is largely the trihydrate of aluminum, and occurs in three general geologic conditions: (1) in place, derived from granite; (2) in place, derived from clays, slates, and shales; and (3) transported, as an alluvial deposit in tin-bearing sands. The bauxite derived from granite shows pseudomorphs after feldspar, and in some of these, relict Carlsbad twinning can be seen. Reserves for districts are estimated to be: Rangam, 29,200 tons; Batoc Balei,

480,000 tons; Iboel, 105,000 tons. The deposits are thin, rarely more than a meter thick, and usually much thinner. The bauxite appears to be confined to the northern part and to the central coastlines; deposits are especially numerous near Muntok on the western extremity of the island.

**Junner, N. R.**

1. Mineral wealth of the Gold Coast: West African Rev., p. 117, London, July 1936.
2. Calcination tests on bauxite: Gold Coast Geol. Survey Dept. Rept., p. 7, Accra, 1938.

Tests on two bulk samples of gibbsitic bauxite from the Sefwi Bekwai and the Yenahin deposits, showed that if the bauxite is ground to −10 mesh, it loses most of its water at 225° C, but loses a little more at 300° and 450° C. If it is ground to −1″ mesh, the process is slowed up, and does not occur at 225° C exactly. There is also appreciable loss of water at 700° C.

3. The geology and mineral resources of the Gold Coast: 12 p., 1 pl. (min. res. map), Accra, Gold Coast Geol. Survey Rept., no date [1938?].

Brief sections on bauxite are found on pages 1 and 10. Location of all mineral deposits are shown on a small-scale map.

4. (and James, W. T.) Chemical analyses of Gold Coast rocks, ores, and minerals, with appendix: Mineral analyses of Gold Coast waters by J. S. Dunn: Gold Coast Geol. Survey Bull. 15, 66 p., 1947.

Analyses of samples of bauxite from deposits in the Gold Coast are given on pages 37 to 46.

**Just, Evan.**

1. Origin of bauxite deposits: Econ. Geology, v. 28, no. 5, p. 506–507, 1933.

Bauxite deposits occur along the Devonian-Carboniferous unconformity in the Tikhvin region, about 300 kilometers east of Leningrad, Russia. Some of the thicker bauxite lenses were found to be convex downward, and two of the deposits were cut by seams of black, carbonaceous clay. Both the black clay and the bauxite are considered to have been deposited in swamps or ponds. However, at other places, carbonaceous material is not present in great quantity, nor are there other indications of humic acid, such as sulfides and sulfates. It is considered that humic acid is not the only limiting factor in bauxitization.

2. An Arkansas travelogue: Eng. Min. Jour., v. 143, no. 12, p. 63–66, 6 figs., 1942; v. 144, no. 1, p. 46–49, 7 figs., 1943.

The mining of quicksilver, barite, diamonds, manganese, zinc, and bauxite and the further economic possibilities of each are discussed. The general location of bauxite deposits in Saline and Pulaski Counties and the geologic occurrence are given briefly. Mining companies are listed and the location of processing plants is mentioned.

**Kagaya, Bunziro.**

On alunite deposit of Ugusu in Izu Province [Japan]: Nippon Kogyo Kwaishi v. 51, s. 10, p. 109–17, Tokyo, 1935 [Japanese, English summary].

The alunite deposit at Ugusu in Izu province probably contains 56 million tons of ore. It averages about 35 percent of alunite; therefore, the total quantity of alunite is estimated to be about 19 million tons. The deposit is considered to have been formed by the action of ascending hot sulfur solutions on volcanic deposits. The material is amenable to concentration by flotation processes and has been referred to as an ore of aluminum.

**Kaiser, E.**

Über Bauxit- und Lateritartige Zersetzungsprodukte: Deutsche geol. Gesell. Zeitsch., Monatsber. Verh., Band 56, p. 17–26, 1904 [German].

The formation of bauxite and laterite which overlie basalt at Kuckstein near Oberkassel, Germany, is discussed. It is postulated that carbonate waters first transformed the aluminous silicates of the underlying basalt into hydrous aluminum silicates; then introduction of alkaline solutions caused precipitation of alumina.

**Karzhavin, N. A. (Karjavin).**

1. Osnovnyye itogi geologopoiskovykh rabot na mezozoyskiye boksity na vostochnom sklone Urala v 1935/36 g. [Principal results of the geological prospecting work for Mesozoic bauxites on the eastern slope of the Urals, in 1935–36]: Razvedka nedr v. 7, no. 4, p. 6–13, 6 figs., Moscow, 1937 [Russian].

The author discusses the occurrence, character, and genesis of the Mesozoic bauxite deposits along the eastern slope of the Urals, U.S.S.R.

2. The deposits of bauxites "Krasnaya Shapochka," east slope of the North Urals: Akad. nauk SSSR Izv., Ser. geol. no. 4, p. 12–22, Moscow 1942 [Russian, English summary.]

A bauxite deposit, consisting largely of diaspore, has been discovered at the base of limestones of Givetian (Devonian) age in the Krasnaya Shapochka area, U.S.S.R.

**Katzer, Friedrich.**

Das Bauxitvorkommen von Domanovic in der Herzegowina: Zeitschr. prakt. Geologie, 25 Jahrg., p. 133–138, 2 figs., 1917 [German].

The bauxite deposits of Domanovic in Herzegovina, Yugoslavia, overlie *Alveolina* limestone and are overlain by Nummulitic limestone so that the bauxite is considered to be middle Eocene in age. In these deposits thin beds or stringers of manganese are found precipitated at the top and the bottom of the bauxite bed.

**Kelley, J. V.**

High alumina-iron laterite deposits, Columbia County, Oreg.: U. S. Bur. Mines Rept. Inv. 4081, 51 p., 8 figs., May 1947.

The deposits studied are 3–9 miles west of St. Helens, Oreg. Seven deposits were investigated and are described; in these, 99 auger holes were drilled and 2 adits driven. The drill logs and chemical analyses of the samples are included.

**Keppen, A. de.**

L'industrie de la bauxite dans le département du Var [France]: Chambre syndicale française des Mines métalliques, Paris, 1916 [French].

**Kerner, Fritz von (Kerner-Marilaun).**

1. Geologie der Bauxitlagerstätten des Südlichen Teiles der oesterreichisch-ungarischen Monarchie: Berg- und Hüttenm. Jahrbuch, Band 64, Heft 3, p. 139–170, 6 figs., Vienna, 1916 [German].

The bauxite deposits of both the coastal area and the hinterland of the former Austro-Hungarian Empire are related to a hiatus in the geologic column. The formation of bauxite in the Dalmatian region, Yugoslavia, is postulated to have followed deposition of early Eocene limestone over parts of the irregular surface

of Cretaceous limestone. The area was subsequently folded, uplifted, and denuded. Bauxite deposits were formed on the Eocene limestone and in part on the Cretaceous. An Eocene breccia was then laid down on this surface. Later diastrophism folded and faulted these beds, including the bauxite, so that the deposits are discontinuous and in places steeply dipping. Cross sections of several areas show details.

2. Geologie der dalmatinischen Beauxitlager: K.-k. geol. Reichsanst. Verh., Jahrg. 1916, p. 72–73, Vienna, 1916 [German].

This is a very brief general discussion of the occurrences of bauxite in Dalmatia, Yugoslavia.

3. Bauxit und Braunkohle als Wertmesser der Tertiärklimate in Dalmatien: Akad. Wiss. Wien Sitzungsber., Band 130, Abt. 1, p. 35–70, 1 fig., 1921 [German].

From a study of the bauxite and brown coal deposits in Dalmatia, Yugoslavia, the climates of the several epochs in the Tertiary are postulated. The work is largely on temperature, with some data on rainfall, and gives summer and winter average yearly temperature by epochs.

4. Beitrag zur Kenntnis der ostadriatischen Bauxite: Berg- u. Hüttenm. Jahrb., Band 69 and 70, Heft 1, p. 73–78, 2 figs., Leoben, 1921–22 [German].

The bauxite deposits described extend in the eastern Adriatic from the Istrian peninsula (Italy) southward along the entire coast of Yugoslavia. The report contains the results of further work since 1916. The bauxite occurs at various stratigraphic horizons. Deposits near Sedramic, Domanovic, Kalun northwest of Dernes, Medvid, Blizanzi, Imotski, and Grislic are taken as types and the stratigraphic relations given in some detail. In the Sedramic type, bauxite occurs between the Rudistid limestone (Cretaceous) and an Eocene breccia; in the Dominovic type, it lies between the *Alveolina* (lower middle Eocene) and the Nummulitic (middle Eocene) limestones; in the Kalun type, it is between *Alveolina* limestone and Eocene breccia; in the Medvid type, it lies between the Nummulitic limestone and the base of the Eocene breccia; in the Blizanzi type, it occurs between the *Alveolina* limestone and a sandstone (Tertiary); in the Imotski type, it is between the *Alveolina* limestone and the Nummulitic marl; and in the Grislic type it is in the Eocene breccia.

5. Klimatologische Analysis der Terra rossa-Bildung: Akad. Wiss. Wien, Math. naturw. Kl. Sitzungsber., Band 132, Abt. 1, Jahrg. 1923, p. 119–142, 1 fig., 1924 [German].

The climatic factors relating to the formation of terra rossa in the Mediterranean region are discussed in detail.

6. Neuer Beitrag zur Kenntnis der ostadriatischen Bauxite: Montan. Rundschau, 18 Jahrg., no. 24, p. 725–729, 4 figs., Berlin, 1926 [German].

In the Herzegovina region of Yugoslavia the bauxite deposits occur as irregularly shaped masses in steeply dipping folded and faulted rocks, primarily limestones. Nearly everywhere bauxite overlies the irregular surface of the Rudistid limestone. The bauxite is gray, red and yellow mottled, and has a pisolitic texture.

7. Die Palaeoklimatische Bedeutung der Bauxite: Geol. Gesell. Wien Mitt., Band 18, p. 163–173, 1927.

8. Alterbeziehungen zwischen Bauxitlagerstätten und Kohlenlagern auf der Ostseite der Adria: Montan. Rundschau, 20 Jahrg., nr. 6, p. 173–177, Berlin, 1928 [German].

Certain conclusions can be drawn as to the age relationships between bauxite

and coal deposits in areas along the Dineric coastline, principally in Yugoslavia. It is considered that commercial deposits of coal indicated deposition in climates at least partly warm and humid, as do bauxite deposits. Therefore the coincidence of these deposits was investigated. Both coal and bauxite were formed during the same interval of late Tertiary time. In the early Tertiary, however, although the formation of each continued over a longer time, the formation of the bauxite ceased at about the beginning of the coal. During the Liburnian intermediate period, both began at about the same time, but the formation of bauxite continued longer. In strata of Cretaceous age, carbonaceous marls take the place of coal beds and are equivalent to minor bauxite deposits. In the Triassic, also, the formation of both occurred during the same interval.

9. Bemerkungen zur Nomenklatur der Bauxite: Montan. Rundschau, 20 Jahrg., no. 9, p. 257–259, Berlin, 1928 [German].

The contributions of Kispatic, Harrassowitz, Fox, and others to the nomenclature of bauxite deposits, made on the basis of chemical analysis or on mode of origin, are outlined and compared.

10. Die Klimatischen Bildungsbedingungen der Deutschen Käoline und Bauxite: Akad. Wiss. Wien Sitzungsber., Abt. 1, Band 137, p. 563–594, 1928; abs., Akad. Wiss. Wien Anz., Band 65, p. 202, 1928 [German].

A detailed study is presented of the probable climate, rainfall, and temperature at the time of the formation of the kaolin and bauxite deposits of Germany during the Eocene, and also that during the Miocene and Pliocene. It is concluded that during early Tertiary time no part of Germany had a true savanna climate, but that it probably had a pronounced summer rainy season and dry winter with low evaporation which is considered favorable for the formation of laterite. An ice-free polar region during the Tertiary would have resulted in warmer Gulf and Polar streams and hence a more equitable climate in insular Europe. Thus the European climate in the early Tertiary could have had a milder summer rainy season and much warmer dry winter than at present.

**Kerr, Paul F.**

Bauxite "eggs": Am. Mineralogist, v. 31, nos. 3–4, p. 199, 1946.

More or less spheroïdal aggregates of bauxite are found at Poços de Caldas, Brazil and in Surinam. These are believed to have been produced by gel-shrinkage at a final stage of laterization. They are hollow or are filled with gibbsite powder and are several inches larger in diameter than pisolites.

**Kesser, Alexopoulos.** *See* Delyannis, Ant. A.

**Khodalevich, A. N.**

K voprosu o vozraste paleozoyskikh boksitov vostochnogo sklona Severnogo Urala (The age of bauxite deposits lying between Silurian and Devonian strata on the eastern slope of the Northern Urals, Russia): Problemy Sovetskoy geologiya, tom 8, nos. 8–9, p. 106–111, 1 fig., 1938 [Russian].

**Kilroe, J. R.** *See also* Cole, Grenville A. J.

On the occurrence and origin of laterite and bauxite in Germany: Geol. Mag. decade V, v. 5, p. 534–542, London, 1908.

A study of the Vogelsberg iron-ore and bauxite deposits indicated that the ores do not occur in a single zone, nor are they associated with lignite. The iron is formed from lavas of the lowest stage; and the bauxite from those of the succeeding stage. The overburden is thin. The age of the deposits is probably late Pliocene.

**Kinahan, G. H.**

On the iron ore measures of County Antrim: Manchester Geol. Soc. Trans., v. 22, p. 458–466, 1894.

In places, the iron ore deposits contain appreciable quantities of an aluminum hydrate called alumyte. This material is compared with the French bauxyte and the German woeheinyte. Chemical analyses show that the alumyte contains 43–52 percent alumina, 1.5–1.3 percent iron, and 28–12 percent silica.

**King, Philip Burke.**

(and Ferguson, Herman White, Craig, Lawrence Carey, and Rodgers, John). Geology and manganese deposits of northwestern Tennessee: Tenn. Dept. Conserv., Div. Geol. Bull. 52, 283 p., 12 pls., 31 figs. (incl. geol. maps), 1945.

*Bauxite, p. 210–214.*—The Watauga and Red Bird Hill mines 3½ miles north of Elizabethtown occur on flat benches which are probably remnants of an old valley floor. The bauxite deposits fill "steep-sided depressions in the residual clay of the Shady dolomite." The history of production and the old workings of the Watauga mine are described. No ore is known to have been produced from the Red Bird Hill mine.

**Kinoshita, Kameki.**

Bauxite deposits in France and Italy: Japanese Imp. Geol. Survey Rept. 108, p. 93–111, 6 figs., 1930 [Japanese].

**Kišpatić, M.**

Bauxite des Kroatischan Karstes und ihre Entstehung: Neues Jahrbuch, Beil.-Band 34, p. 513–522, Stuttgart, 1912 [German].

The bauxite deposits of Croatia, Yugoslavia, are described; chemical analyses, and results of petrographic studies are included. The origin of these deposits and of bauxite and laterite in general is discussed, together with a review of the literature. The author concludes: (1) all the bauxite deposits in Crotia occur overlying limestones. (2) Chemical analyses show a water content equivalent to that necessary for the formation of $Al_2O_3 \cdot 3H_2O$. (3) Sporogellite, normally colorless or white, in samples is generally stained by amorphous iron oxide. (4) Diaspore has not been noticed in these deposits but may possible form at the expense of the sporogellite. (5) Hydrargillite is a characteristic mineral of laterites derived from silicate rocks, but it, in addition to sporogellite and diaspore may occur in deposits derived from limestone. (6) Silica is variable in amount and is present as silicates, amorphous hydrous silicates, and quartz. (7) Titania and zirconia are present as rutile and zircon. (8) Accessory minerals are similar to those in the underlying limestone or dolomite, except brookite which may be authigenic. (9) Bauxite may be an alluvial deposit from decomposed limestone or dolomite. The bulk of the material is the amorphous colloid, sporogellite, with minor amounts of diaspore and hydrargillite. Bauxite is a mixture and cannot be spoken of as pure or not, but only as good or poor.

**Kitson, A. E.**

1. Report of the Geological Survey for the year 1917: 7 p., Accra, Government of the Gold Coast, 1919.

An examination of the bauxite deposit at the top of Mount Ejuanema is briefly reported. Three trenches were cut into the deposit. A few chemical analyses are included. Other deposits on the Kwahu Plateau are noted.

2. Report of the Geological Survey for the year 1919: 15 p., Accra, Government of the Gold Coast, 1920.

*Bauxite, p. 6–7.*—A résumé of the work on the Mount Ejuanema bauxite deposits during 1919 is given. Reserves are roughly estimated to be about 3 million tons.

3. Report on the Geological Survey for the year 1921: 12 p., Accra, Government of the Gold Coast, 1922.

*Bauxite, p. 8–9.*—Thick deposits of bauxite were discovered on a group of hills 4 to 6 miles northeast of Sefwi Bekwai. A similar deposit occurs on Mount Kawkawti near Akwadum. Both are described briefly.

4. Report on the Geological Survey for the period 1st January, 1922–31st March 1923: 54 p., Accra, Government of the Gold Coast, 1924.

*Bauxite, p. 19, 50–51.*—The discovery of bauxite on the Angwinyare and Sumanchichi Hills, in the Sefwi district, Gold Coast, is announced. Work on the deposits on Mount Supirri, near Affo, is reported.

5. The mineral resources of the Gold Coast: 20 p., London, Drowley, Ltd., 1924.

A short section on bauxite, pages 7 to 9, gives the location of deposits, average chemical analyses, and some estimates of reserves.

6. The bauxite deposits of the Gold Coast: Min. Mag., v. 33, no. 5, p. 265–270, 6 figs., London, 1925.

The principal bauxite deposits of the Gold Coast are those on Mount Ejuanema and on Mounts Supirri, Ichinniso, and Kanaiyeribo, near Sefwi Bekwai and in the Colony. There are also large deposits on Mie Mount (Kwamisa Bepo), and the Yenahin district. The deposits on Mount Ejuanema are described in greatest detail. These deposits are considered to have been formed by the removal of silica from the weathered clay shales, leaving aluminum hydrate. Iron probably was introduced after the formation of the bauxite. Estimates of reserves and grade of ore are included.

7. Outlines of the mineral and water-power resources of the Gold Coast, British West Africa, with hints on prospecting: Gold Coast Geol. Survey Bull. 1, 56 p., 13 pls. (incl. min. res. map), 1925.

*Bauxite, p. 16–34.*—Bauxite in the Gold Coast occurs in large deposits in the Colony and in Ashanti. The deposits are considered to be remnants of formerly widespread beds, and now are found only capping flat-topped mountains or on somewhat lower ridges and spurs. The principal deposits in the Colony are those on Mount Ejuanema, Kwahu, and on Mounts Supirri, Ichinniso, and Kanaiyeribo near Sefwi Bekwai; in Ashanti the largest occur on Mie Mount (Kwamisa Bepo), and in the Yenahin district. The geology and a description of the bauxite are given briefly for each of these areas, as well as for other less important ones.

8. (and Felton, W. J.) References to occurrences of economic minerals in the Gold Coast, recorded in the Annual Report of the Director, Geological Survey: Gold Coast Geol. Survey Bull. no. 5, p. 4–7, 1930.

This paper lists occurrences of bauxite and other economic mineral deposits together with a reference to the Annual Report in which they are described. Only brief notes on the deposits are given, but all deposits known to date, irrespective of size or grade, are mentioned.

9. Some economic minerals of the Gold Coast: Teachers' Jour., Accra, 1930.

**Kleinhans, Richard E.**

The light metals industries in China: U. S. Bur. Mines Min. Trade Notes, Special Supp. 23 (to v. 26, no. 2), 18 p., 2 figs. (geol. sections), Feb. 1948.

*Aluminum-Ores, p. 2–7.*—In the Liaoning region, aluminous shale containing diaspore was worked by the Japanese. Similar material is shown to occur in Hopeh Province in the Kaiping basin. The deposits in Shantung contain an estimated reserve of several hundred million tons, in which the aluminum hydrate is also largely diaspore. These beds crop out in the Tsi-po coal fields, and in the Tzechwang, Changch'iu, and Itu districts. In Kweichow similar diaspore deposits have been mined at Yun-Wu-Shan and Chiu-Chia-Lu. In Yunnan Province, diaspore shales containing some boehmite occur in the Anning, Kunming, Fumin, and Chengkung districts. Reserves are estimated to be about 4.9 million metric tons. The only source of material high in gibbsite is that in Changpu Hsien, in Fukien Province. The silica content is generally low. Reserves are small and estimated to approximate only half a million tons.

**Klingner, Fritz Erdmann.**

Geologischer Bau und Mineralschätze der deutschen Kolonien: 62 p., 7 figs., Berlin, Preuss. geol. Landesanst., 1938.

The geology and mineral resources of all of the German colonies are presented in a relatively short text, but the locations of the deposits are shown by symbols on maps of each colony. Bauxite is known to occur in Togo and the Cameroon in Africa; the text also mentions deposits in Northeast New Guinea (Deutsch-Neuguinea), but localities are not shown on a map.

**Knecht, Theodoro.**

1. Nota sobre bauxita concrecionáira e sua gênese no Municipio de Guaratinguetá: São Paulo Inst. Geog. Geol. Rev., v. 3, no. 4, p. 338–341, 1 fig., 1945 [Portuguese].

In a road cut 232 kilometers from Guarantinguetá on the road to Cunha, São Paulo, a lenticular bauxite bed crops out. It is as much as 1 meter thick and is composed of bauxite concretions and pebbles up to 25 centimeters in diameter. The bed is overlain by a surficial blanket of yellow sandy and clayey soil. The bauxite is underlain by a decomposed granite zone which, in turn, rests on a medium-grained biotite granite. No bauxite occurs in the vicinity on schists of the São Paulo series.

2. (and Bendix, Otto (cartography)). Ocorrências minerais do Estado de São Paulo, vol. I: 144 p., 8 maps, 35 photographs, São Paulo Inst. Geog. Geol., 1950.

The mineral resources of part of the State of São Paulo, Brazil, are discussed in relation to the geography and economy and are shown by symbols on maps of the municipalities of São Paulo, Mogí das Cruzes, Suzano, Poá, Guarulhos, Franco da Rocha, Santana de Parnaíba, and Barueri. A brief résumé of the history of the area and a bibliography accompanies each. The maps, in addition to mineral resources, show drainage, roads, trails, railroads, towns, villages, and the generalized topography. The paper is profusely illustrated with photographs and maps. Bauxite occurs in the municipalities of Sáo Paulo, and of Mogí das Cruzes, Suzano, and Poá.

**Knibbs, N. V. S.**

The industrial uses of bauxite: 141 p., London, Ernest Benn, Ltd., 1928.

The location and occurrence of bauxite deposits in the world, their origin and composition are treated rather briefly, but references to the numerous papers cited

are listed at the end of each chapter. The uses, discussed by chapters, are: the manufacture of aluminum, aluminous cement, alumina refractories, oil refining, sulfate of aluminum, other compounds of aluminum, and alumina abrasives. The grade and type of ore required, the various processes of manufacture, the quality or performance of the product, and the uses are discussed in detail for each and give a comprehensive picture of the whole industry. An excellent bibliography is appended.

**Koebrich, ———.**

Magnetische Erscheinungen an Gesteinen des Vogelsberges insbesondere Bauxiten: Zeitschr. prakt. Geologie, Jahrg. 13, p. 23–36, 1 fig., 1950 [German].

The magnetic properties of many different rock types, iron ores, and bauxites have been measured in the Vogelsberg region, Germany, and are presented in a table which lists 212 samples tested.

**Kormos, Theo.**

Hydrargillit es Kenes bauxit Istriaban: Bányászati és kohászati lapok, evi 12, szamabel, Budapest, 1930.

Chemical analyses of a gray pyritic bauxite and shale from several localities in the Istrian Peninsula, Italy, show about 7–10 percent sulfur, 6–17 percent iron oxide, 11–34 percent silica, and 48–21 percent alumina. The bauxite appears to grade laterally into the gray pyritic shales. It is also considered to be genetically related to a red bauxite in which the iron occurs as the sesquioxide.

**Krishnan, M. S.**

1. Bauxite on Korlapat Hill, Kalahandi State, Bihar and Orissa [India]: India Geol. Survey Rec., v. 59, pt. 4, p. 419–422, 1 fig., 1926.

Korlapat Hill extends about 8 miles from north to south and about 1 mile from east to west; its flat top is capped with laterite. The upper 10 feet is red, ferruginous laterite in most places and becomes lighter in color with depth. The hill is underlain by khondalite, a quartz-garnet-sillimanite-graphite schist which weathers easily. Four analyses of laterite show compositions of 25 percent $Al_2O_3$ and 53 percent $SiO_2$, as well as 62 percent $Al_2O_3$, and 2 percent $SiO_2$; $Fe_2O_3$ ranges from 2 to 9 percent.

2. Laterization of khondalite: India Geol. Survey Rec. v. 68, pt. 4, p. 392–399, 2 figs., 1 pl., 1935.

The name khondalite is used to designate certain easily altered crystalline schists consisting of feldspars, quartz, garnet, sillimanite, and graphite. Weathering starts with the feldspars (orthoclase, oligoclase-andesine) and garnet (composition not given); the former is "kaolinized" and the latter changed to brown limonite. Sillimanite is less readily altered to an isotropic material which "is probably a colloidal hydrated oxide of alumina". In general silica, magnesium, calcium, and the alkalies are removed, and alumina, iron, manganese, and titanium are concentrated. Chemical analyses are given of fresh rock, decomposition products, and laterite; and a ternary diagram, Si (Si)–Sol (Ca, Mg, K, Na)–Ins (Al, Fe, Ti), is set up.

3. Bauxite in the Shevaroy Hills, Salem district, Madras Presidency: India Geol. Survey Rec., v. 77, Prof. Paper 8, 16 p., 1 pl., 1942.

Bauxite occurs as a capping 20 to 30 feet thick on six flat-topped peaks in the Shevaroy Hills, near Salem. The deposits are high in iron and low in silica. Total reserves in the area are estimated at more than six and a half million tons.

By some hand picking during mining, the grade of ore could be improved to more than 55 percent alumina and less than 10 percent ferric iron.

**Krotov, B. P.**

1. Role and significance of epeirogenetic movements in the formation of deposits of iron and manganese ore and bauxites: Akad. nauk SSSR Doklady, S., v. 33, no. 1, p. 54–56, Moscow, 1941 [English].

The importance of epeirogenetic movement is in the formation of favorable conditions such as gulfs, bays, lakes, etc., for the deposition of iron, manganese, or bauxite. In the Krasnaya Shapochka bauxite deposit, three recognizable zones in ascending order are: a breccia-like bauxite, a red pisolitic bauxite, and a dark gray and greenish gray bauxite. The minerals present indicate that the deposit was formed during a transgression of the sea.

2. "Friable" bauxites and the Cretaceous crust of bauxite weathering in the Sokolov deposit of the region of Kamensk (central Urals): Akad. nauk SSSR Doklady, v. 35, no. 3, p. 76–78, Moscow, 1942 [English].

A study of the bauxite deposits near Kamensk shows the types of ore, from top to bottom, to be: (1) friable, (2) stony, and (3) clayey bauxite. The absence of friable bauxite in places is due to erosion of the upper part of the deposit before it was buried by younger sediments.

3. (and Stolyarova, T. I.) Sokolovka deposit of pisolitic ferriferous bauxites (Kamensk district, Chelabinsk Province) and its genesis: Akad. nauk SSSR Izv., Ser. geol., no. 4, p. 47–70, 7 figs., Moscow, 1942 [Russian, English summary].

A study of the Sokolov bauxite deposit on the eastern slope of the central Ural Mountains indicates that it occurs within lacustrine strata of Cretaceous age.

**Kuhl, Jan.**

Sur les argiles bauxitiques de Najdziszów et le gisement de halloysite de Mierzęcice au nord du Bassin de Dąbrowa [Poland]: Towarzystwa Nauk. Warszaw. Archiwum Mineralog., tom 9, p. 105–115, 1 pl., 1933 [Polish, French summary].

The author gives the chemical and mineralogic composition and optical properties of white and red clay from Najdziszów and of one clay from Mierzęcice, Poland. The mineralogic composition of the white clay is: sericite, 2.74 percent; chalcedony, 21.61 percent; limonite, 0.14 percent; gibbsite, 63.38 percent; rutile none; and halloysite, 7.09 percent. The mineralogic composition of the red clay is: sericite, 4.74 percent; chalcedony, 4.63 percent; limonite 0.31 percent; rutile, 0.12 percent; gibbsite, 59.53 percent; and halloysite 30.57 percent. The mineralogic composition of the clay at Mierzęcice is: sericite, 4.82 percent; quartz, 1.33 percent; limonite, 0.32 percent; rutile, 0.09 percent; gibbsite, none; and halloysite, 93.33 percent.

**Kühn, Othmar.** *See* Dittler, Emil.

**Kurtz, Horace F.** *See* Mote, R. H.

**Kuznetsov, Yu. S.**

Poleznyye iskopayemyye drevney kory vyvetrivaniya v Novosibirskom rayone: Western Siberia, Zapadno-sibir geol. tresta Vestnik, no. 1, p. 16–29, 1937 [Russian].

Describes economic mineral deposits formed by weathering processes—kaolin, bauxite, and laterite—of the Novosibirsk region.—* v. 5, 1937.

**Labazin, G. S.**

1. (On a discovery of bauxite boulders in the Salair Range): U. S. S. R., geol. kom., Glav. geol.-razved. Uprav. Izv., tom 50, vyp. 91, p. 1337–1345, 1931 [Russian, English summary].
2. O mestorozhdeniyakh boksita v Salairskom rayone (Bauxite occurrence in the Salair region [Russia]): Western Siberia, Zapadno-sibir. geol.-razved. tresta Vestnik, no. 2, p. 26–33, Tomsk, 1932.

**Lachmann, R.**

Neue ostungarische Bauxitkörper und Bauxitbildung überhaupt [Bihar dist., Hungary]: Zeitschr. prakt. Geologie, 16 Jahrg., p. 353–362, 3 figs., 1 pl. (incl. maps), 1908 [German].

An index map shows the location of the deposits in the Bihar Mountain district, Rumania; larger scale maps of individual deposits have surface contours which show the relation of the occurrence to topography. Chemical analyses are included. Reserves are estimated to be between 5,870,000 and 18,700,000 tons. The various theories for the origin of bauxite are discussed.

**Lacourt, F.**

Bauxita e arila em Ouro Preto, Minas Gerais: Mineração e Metallurgia, v. 2, no. 12, p. 373–374, 3 figs., Rio de Janeiro, 1938.

The following deposits near Ouro Preto in the state of Minas Gerais are briefly described: Morro do Cruzeiro, Fazenda do Tesoureiro, Fazenda do Manso, Grama, Saramenha, Baú, Rodrigo Silvo, and Dom Bosco. Chemical analyses of 11 samples are included. The location, size, and quality of the deposit if known, owners, operators, or companies exploring the bauxite are included.

**Lacroix, A.**

1. Groupe du diaspore, *in* Minéralogie de la France et de ses colonies, tome III, p. 339–349: Paris, Librairie Polytechnique, 1901–1909, [French].

The optical properties of diaspore and bauxite are given. The deposits of bauxite in France, and of laterite in the tropics and in France are described. The name bauxite refers to an aluminum hydrate rock analyzed by Berthier in 1821. Bauxite is considered by Lacroix to consist of the monohydrate (diaspore), the dihydrate, or the trihydrate (hydrargillite or wochenite). The French bauxite is largely the monohydrate, in some places high in iron oxide and silica. Microscopic examination has shown it to be colloidal. Because it is a mixture of various colloidal aluminum hydrates, iron hydrates and other impurities, bauxite is considered to be a rock, not a mineral.

2. Les latérites de la Guinée et les produits d'altération qui leur sont associés: Mus. d'histoire nat. Nouvelles archives 5th ser., tome 5, p. 255–358, 8 pls. (incl. photomicrographs), Paris, 1913 [French].

Weathering products characterized by the removal of alkalies, lime, magnesium, and silica from the original rock, and by the persistence of the hydrates of alumina and iron and a small quantity of titania are defined as laterites. Two zones are distinguished, the "zone de départ" and the overlying "zone de concrétion." In the alteration of gabbros, diabases, and nepheline syenites, the zone de départ lies with a sharp contact on the fresh rock, and there is no gradual transition. In this zone the titania, iron, and alumina contents are in the same proportion to each other as in the original rock. The essential feature is the replacement of feldspar by hydrargillite to form vesicular pseudomorphs and the consequent retention of the texture of the original rock. In the alteration of peridotites, the

zone de départ is characteristically ocherous, largely ferric colloids, with some alumina. Mica schists, gneisses, and granites, however, consist of kaolinite and clay in the zone de départ and are distinguished by a gradational contact with the underlying rock.

In the zone de concrétion the iron and aluminum hydroxides are concentrated and a resistant iron cuirass, concretions, or pisolites are characteristic. Removal of silica in this zone is more important in the clayey materials derived from schists, etc.

Latèrites alluvionnaires are equivalent to Fermor's lateritites, and latèrites d'alluvions to his lateritoids.

3. Les latérites de Guinée: Acad. sci. Paris Comptes rendus, tome 158, p. 835–838, 1914 [French].

This is a résumé of the author's paper "Les latérites de la Guinée et les produits d'altération qui leur sont associés," (see Lacroix 1), 1913. In French Guinea, subaerial weathering of rocks proceeds with the removal of the alkalies, lime, magnesium, and silica from the original rock and the persistence of the hydrates of aluminum and iron and a small quantity of titanic acid. Two zones can be distinguished, the "zone de départ" and the "zone de concrétion." In the first, the structure of the original rock is retained. In the alteration of gabbro, diabase, and nepheline syenite, the change is sharp, and the amounts of titania, iron oxide, and alumina are in the same proportions as in the original rock. In the alteration of mica schists and granite, the change is not sharp but is progressive upward, and kaolinite or colloidal aluminum silicates and aluminum hydrates are formed. The amount of the latter increases upward. These alteration products, unlike those derived from the silica-poor rocks, are not true laterites but clayey laterites.

4. Les produits d'altération des roches silicatées alumineuses, et en particulier les latérites de Madagascar: Acad. sci. Paris Comptes rendus, tome 159, p. 617–622, 1914 [French].

Previous studies in French West Africa showed a general type of alteration in which two zones could be distinguished, the "zone de départ" and the "zone de concrétion". The alteration products in the zone de départ are dependent on the composition of the underlying rock. Where it overlies gabbro, diabase, and nepheline syenite, there is a sharp contact, and the silica, lime, and the alkalies have been removed. Gibbsite tends to crystallize. However, overlying granite, gneiss, and mica schists, the contact is not sharp, and aluminum silicates characterize this zone, although upward they may be changed to the aluminum hydrate. In the zone de concrétion silica is further eliminated. The accumulation of a hard ferruginous capping is typical of these deposits. However, the more recent studies in Madagascar show a somewhat different situation. The ferruginous lateritic cover is not generally found; a red earth (terre rouge) is more common. A second difference is that diabase and basalt do not exhibit the zone de départ in weathering. A type of weathering not occurring in Guinea is the formation of gibbsitic laterite containing some quartz and very little iron. Such material overlies granite. This type of alteration is progressive from bottom to top, and when complete has an open texture in which can be seen relicts and pseudomorphs after the feldspar in the original rock. In general the red earths of Madagascar are not laterites, but clayey laterites.

5. Altérations des roches, *in* Minéralogie de Madagascar, tome III, p. 91–149, 4 pls.: Paris, Soc. d'Editions Geog., Maritimes et Coloniales, 1923 [French].

Laterite is considered to be the final weathering product of rocks in tropical regions and hence is not confined to material derived from aluminous silicate

rocks. As a result of previous studies in French Guinea and the Sudan, two zones were distinguished in laterite, (1) the "zone de départ", and (2) the "zone de concrétion." In the first the silicates are broken down and most of the alkalies, lime, and magnesium with a variable amount of silica are removed. The second is at the surface; little silica is present, the iron and alumina are concentrated, and concretions are characteristic. In Madagascar which extends through 14° of latitude, and from sea level to 2,000 meters in altitude, these two zones are not easily distinguished and the weathering products are more complex. Quartzose laterite, formed from quartz-bearing rocks—pegmatites, granite, and gneiss—contains the free quartz present in the parent rock. Microscopic examination of such laterite shows the feldspar replaced by gibbsite, especially along cleavages, and forming skeletonlike pseudomorphs in which the cavities and veinlets may be filled with colloidal clay and kaolinite. Weathering products of quartz-free igneous rocks—gabbros, basalt, amphiboles, and feldspathic rocks—are similar to those found in the zone de départ in Guinea; that is, the feldspar is replaced by aggregates of gibbsite crystals, and iron-stains, ilmenite, pyroxene, and amphibole are present. The zone de concrétion is absent and the resulting material, is designated a siliceous gibbsitic laterite. Nepheline syenite and trachytes are weathered to similar material.

Terre rouge, a clayey laterite, and bauxitic laterite are prominent in Madagascar. The weathering of granite and gneiss to kaolin is very common. The weathering products of quartzose and calcareous sediments are characteristically high in iron.

6. Les phénomènes d'altération superficielle des roches silicatées alumineuses des pays tropicaux—leurs conséquences au point de vue minier, *in* Introduction aux Études minières coloniales, no. 2, p. 19–47, Paris, Bur. d'Études Géol. Minières Coloniales, 1934 [French].

The paper presents a discussion of the concepts of the alteration of rocks to form laterite. The contributions of Buchanan, Max Bauer, Berthier, and others are cited. The alteration products in Madagascar, French West Africa, Indo-China, and the general types of laterite are described. The second part of the paper shows the effect of altered gangue material on the mining of graphite, tin, and other vein minerals in areas of profound weathering.

**Ladoo, Raymond D.**

Bauxite: Occurrence, mining, and uses: Eng. Min. Jour., v. 114, no. 19, p. 805–809, 1 fig., 1922.

The bauxite deposits of the world and mining methods are briefly described. Domestic and world production, consumption by industries, and the value of bauxite are given for several representative years between 1913 and 1920.

**Lang, J.**

Über Bauxit von Langsdorf [Germany]: Deutsche chem. Gesell. Ber., 17 Jahrg., p. 2892–2894, 1884 [German]; abs., Neues Jahrbuch., 1886, Referate II, p. 342, Iron and Steel Inst. Jour. v. 1, p. 293, 1886 [German].

Bauxite was discovered near Langsdorf, Germany in about 1884. The deposit overlies basalt from which it was considered to have been derived. A petrographic study and chemical analyses were made on the material, which falls into two classes—braunrothes and hellrothes. These analyze respectively, 5.14 and 10.27 percent silica, 50.85 and 49.02 percent alumina, 14.36 and 12.90 percent iron oxide, and 27.03 and 25.88 percent loss on ignition.

**Lang, Richard.**

Die klimatischen Bildungsbedingungen des Laterits: Chemie der Erde, Band 1, Heft 2, p. 134–154, 1915 [German].

The effects of temperature and amount and distribution of rainfall on the formation of laterites are discussed. In the tropics, the temperature is sufficiently high that the humus cannot accumulate faster than bacteria destroys it. It is considered that humic acid in the percolating waters hinders laterite formation, but pure water favors it. Both a high temperature and a humid climate are, therefore, necessary.

**Langvagen, V. V.** *See* Volkov, A. N.

**Lapparent, Jacques de.** *See also* Hocart, Raymond.

1. Sur la constitution minéralogique des bauxites et des calcaires au contact desquels on les trouve: Acad. sci. Paris Comptes rendus, tome 178, p. 581–583, 1924 [French].

The bauxite deposits of southern France rest on marine limestones of Lias and lower Cretaceous age. They contain variable proportions of crystalline aluminum hydrate as the mineral hydrargillite (gibbsite), the clay minerals kaolinite and halloysite, iron as hematite and goethite, prisms of the titanium mineral rutile, and amorphous aluminum hydrate. The limestones overlying the bauxite deposits carry an admixture of these constituents as well as nodules and fragments of bauxite.

2. L'alumine hydratée des bauxites: Acad. sci. Paris Comptes rendus, tome 184, p. 1661–1662, 1927 [French].

The X-ray studies of Böhm in 1925 established the existence of an aluminum monohydrate which morphologically corresponded to the iron monohydrate, lepidocrocite, and was distinct from the already known aluminum monohydrate, diaspore. Because of this work, the name boehmite is proposed for the mineral by Lapparent who describes its optical properties from similar crystalline material from Ariége and Var, France. The mineral is orthorhombic and appears as crystals consisting of a base (001) and prism (110); the direction of the slow ray is parallel to the long diagonal of the prism; maximum birefringence is of the order of 0.020; and the index of refraction seems to be a little higher than gibbsite.

3. La position stratigraphique des bauxites du Pays de Fenouillet: Acad. sci. Paris Comptes rendus, tome 185, pt. 2, p. 658–659, [French].

The age of the bauxite deposits of Pays de Fenouillet, France, although in an area mapped as Aptian, is probably pre-Aptian inasmuch as the bauxite in reality occurs at the contact of dolomite of Jurassic age and limestones of Aptian (Cretaceous) age.

4. La texture des bauxites et leur origine: Acad. sci. Paris Comptes rendus, tome 185, pt. 1, p. 213–214, 1927.

Microscopic studies of bauxite show a few minerals of high birefringence, principally rutile and anatase, in a dense complex mass of aluminum silicate, and aluminous and ferruginous minerals which form the body of the rock. However, in the bauxites studied, hydrargillite, boehmite, and kaolinite occur as crystals in cracks in pisolites, and in cracks in other parts of the ore. Iron hydroxides may be taken into solution in humic waters and may then be either removed or redeposited after little movement. White bauxites were probably formed by such removal of iron from the red bauxites.

5. Sur la fréquence de murs dolomitiques aux gîtes du bauxite: Acad. sci. Paris Comptes rendus, tome 185, pt. 2, p. 786–787, 1927 [French].

The bauxite deposits of France very commonly occur in dolomite, especially in the Jurassic dolomites, in Var, Hérault, and Ariège. A reason for this is the greater solubility of limestone than dolomite so that the former could be removed and the bauxite deposits then accumulated on, or formed on dolomite. In the region of Barjols (north of Var) and Pays de Fenouillet, bauxite does occur in limestone.

6. Connaissance minéralogique des bauxites du Pays de Fenouillet: Acad. sci. Paris Comptes rendus, tome 186, pt. 2, p. 1560–1561, 1928 [French].

A petrographic study of the bauxite deposits of Pays de Fenouillet showed that they are unusual not only for their geologic occurrence, as described in a previous paper, but also for their mineralogic composition. Whether high or low in iron content, these deposits are characterized by a preponderance of diaspore, $Al_2O_3.H_2O$. Boehmite is not present. Under the microscope, the diaspore is seen to consist of aggregates of very small crystals, and occurs in both matrix and pisolites.

7. (and Stampfel, Ernest). Sur la gibbsite déshydratée: Acad. sci. Paris Comptes rendus, tome 187, p. 305–306, 1928 [French].

The authors report changes in optical properties and loss of water when gibbsite is heated to temperatures of 200°, 300°, 600°, and 1,000° C. Most of the water of crystallization is lost between 200° and 250° C. The mineral becomes opaque when heated to 250° C. but retains some optical properties of gibbsite. Changes at higher temperatures include recrystallization in the orthorhombic system at 600° C. At no temperature did it become amorphous.

8. Les bauxites de la France méridionale: Carte geol. France Mém., p. 187, 9 pls. (incl. microphotographs), 54 figs., Paris 1930 [French].

This paper is an authoritative and comprehensive description of the bauxite deposits of southern France, including detailed mineralogic studies and a discussion of the origin and formation of bauxite.

9. Composition, âge et conditions de gisement des bauxites française: Rev. univ. mines, 8ᵉ sér., tome 4, no. 8, p. 230–236, 1930 [French].

A classification of bauxite into several types is based on the presence of one of the three aluminum hydroxides—gibbsite, diaspore, and boehmite—plus admixtures of silica, iron, and other impurities. The types named and examples of their occurrence are: diaspore bauxite of Pays de Fenouillet, boehmite bauxite of Péreille (Ariège), gibbsite bauxite of Cazouls-les-Béziers (Hérault), and kaolinitic bauxite of Pierrerue (Hérault). Further breakdowns are made on the percent of iron present and on the alumina-silica ratio. The French bauxites are Cretaceous in age; the two main groups of deposits are post-Aptian and pre-Aptian.

10. Les mineraux des bauxites françaises: Soc. Française minéralogie Bull., tome 53, p. 255–273, 6 figs., 1930 [French].

A study of the crystal form and mode of occurrence of the aluminum hydrates and silicates and the iron oxides and hydroxides in bauxites from southern France, the Pyrenees, Languedoc, and Provence showed that gibbsite, aluminum trihydrate, occurs as crystalline masses, especially in small cracks in bauxite. Diaspore, an aluminum monohydrate, occurs in crystal form in certain bauxites. Boehmite, a second monohydrate, occurs in many bauxites, largely as amorphous material but also as orthorhombic crystals; it corresponds morphologically to lepidocrocite, the iron mineral. The principal iron minerals present are hematite(?), goethite, and lepidocrocite. The most important silicate minerals are kaolinite and halloysite. Drawings show the crystal form of the foregoing minerals.

11. De la teneur du titane dans les bauxites: Acad. sci. Paris Comptes rendus, tome 190, p. 1312–1314, 1930 [French].

Titanium in the bauxite deposits of southern France occurs as crystals of rutile and anatase. These are considered to have been part of the detritus deposited syngenetically with the limestones from which the bauxite deposits were subsequently derived. The high titanium content of most Indian bauxites, however, is due largely to ilmenite crystals, which were derived from the weathering of basalts, such as those that underlie the Deccan Plateau.

12. Émeris de Grèce et bauxites: Acad. sci. Paris Comptes rendus, tome 197, p. 75–77, 1933 [French].

Samples of schistose emery from Samos and Naxos Islands, Greece, upon close examination were seen to be ancient bauxites with a deformed pisolitic structure, to consist largely of the mineral diaspore, and to contain the usual minerals associated with bauxite, particularly rutile and anatase.

13. Extension des bauxites á diaspore: Acad. sci. Paris Comptes rendus, tome 196, p. 187–188, 1933 [French].

Diaspore in Pays de Fenouillet, France, occurs in bauxite deposits which are the stratigraphic equivalent of those from Ariège but which are characterized by boehmite. It is suggested that diaspore was formed from boehmite under conditions of higher temperatures for relatively long periods. The term bauxite is extended to include diaspore because of its genetic relation and similarity to boehmite.

14. Gisement et position geologiques des bauxites de Greece: Acad. sci. Paris Comptes rendus, tome 198, p. 1162–1164, 1934 [French].

The principal deposits of bauxite in Greece occur (1) near Parnassas, Amphissa, Ghiona, and Athena; and (2) on the island of Euboea. The bauxite consists primarily of the mineral diaspore. The deposits of the first group overlie limestones of Late Jurassic age and are overlain by sediments of the Late Cretaceous. It is concluded that these bauxites, like those of Provence, France are post-Aptian in age. The deposits of the second group are associated with rocks of Urgonian or Cenomanian age and are considered also to have been formed after the Aptian period.

15. Gîtes singuliers de bauxites en Provence: Soc. géol. France, Ann. 1934, Comptes rendus, fasc. 5, p. 64–66, 1934 [French].

Two unusual types of bauxite deposits found in Provence are described. That at Le Montagne de Regaigna (Bouches-du-Rhone) occurs in Jurassic dolomite in three separate veins, 0.5–4 meters wide and from 1.5 to 3.5 meters apart. That at Aurial is pisolitic, well stratified but mixed with lignite; it occurs in pockets. In both places the bauxite is considered to have been washed into caverns and subterranean channels in the dolomite when the roofs collapsed.

16. D'une laterite, d'un calcaire lacustre et des roches pisolithiques en géneral: Alsace-Lorraine, Carte. geol. Bull., tome 2, fasc. 2, 1935 [French].

17. La structure des monts et la position tectonique des bauxites aux flancs du Parnasse (Grèce): Acad. sci. Paris Comptes rendus, tome 200, p. 161–163, 1935 [French].

The bauxite deposits along the flanks of Mount Parnassas, Greece, occur in an area of limestones and dolomite of Jurassic and Cretaceous age and red schists of Danian (Upper Cretaceous) age which pass into continental deposits (flysch) of Eocene age. Metamorphism in the area affected the schists and flysch somewhat differently than the carbonate rocks, owing to differences in plasticity of the two rock types. A syncline was traced between Amphissa and Gravia. The

structures across the flanks of Mount Parnassas are briefly described. The extent and attitude of the bauxite deposits as well as their texture reflect these disturbances.

18. Boehmite and diaspore in the bauxitic clays of Ayrshire: Great Britain Geol. Survey and Mus. Pract. Geology Summary Prog. 1934, pt. 2, p. 1–7, 1 pl., London, 1936.

A mineralogic study of the bauxitic clays of Ayrshire, Scotland, showed that they contain both boehmite and diaspore. These clays are pisolitic in part, and the pisolites are masses of basaltic fragments around which are concretionary pisolitic growths. Boehmite crystallizes principally as drusy centers in the pisolites. The optical and crystallographic properties of boehmite were redetermined on this material.

It is considered that the bauxite was formed by the hydrolysis of the silicates of basalts in a tropical climate. Fragments of basalt and other material such as clay were washed into sinking basins flooded by humic waters. Hydrolysis of basalt produced an alumina-silica gel from which boehmite and kaolinite crystallized. As subsidence continued, the parts not saturated with the humic solutions were not completely altered. With subsequent rise in temperature, however, diaspore formed in minute crystals. The remainder of the colloid disappeared when kaolinite crystallized, at which time the development of diaspore stopped. Rutile in these deposits is considered an indication that a part of the original material was sedimentary, as it is a result of decomposition of micas.

19. Raisons géologiques de la formation des trois hydroxides d'aluminium naturels: Cong. internat. mines 7$^{e}$ Sess., Paris, 1935, Sec. géologie appl., tome 1, p. 375–379, 1936 [French].

The predominance of one or another of the three aluminum hydroxides permits a classification of bauxite as boehmite bauxite, diaspore bauxite, and gibbsite bauxite. The mineralogy and mode of origin of these are described. The boehmite bauxites are considered to have been formed at the ground-water table; those of gibbsite, above it; and those of diaspore, below it. Thus deposits of the same age need not consist largely of the same bauxite minerals. In some deposits that have had a complex history of uplift, subsidence, and distortion, two or three of them may be present in appreciable quantities. Suggested formulas based on crystal structure are: gibbsite, $Al(OH)_3$; boehmite, $AlO(OH)$; and diaspore, $(H_2O_4)Al_2$.

20. and Hocart, Raymond. Sur la nature minéralogique des hydroxides d'aluminium dans bauxites de l'Afrique occidentale française: Acad. sci. Paris Comptes rendus, tome 207, no. 3, p. 202–203, 1938.

The results of a mineralogic study of bauxite from the high erosion surface between Koulouba and Bamako, French West Africa, and from a lower surface of the ancient delta at Segou-Markala are presented. Pisolites were largely composed of submicroscopic crystals of boehmite with some secondary gibbsite. X-ray analyses, likewise, showed dominant boehmite lines and much fainter ones of gibbsite.

21. Composition mineralogique, structure et origine des émeris de Turquie: Acad. sci. Paris Comptes rendus, tome 223, pt. 1, p. 227–228, 1946 [French].

A study of the emery deposits in Turkey indicates that they were originally bauxite which was subsequently metamorphosed. The essential minerals are corundum, chloritoid, and magnetite. The usual texture is pisolitic. There are three types of metamorphosed bauxite deposits, those of Samos, Naxos, and Turkey; the latter are intermediate in amount of metamorphism.

22. La géochimie du chemin des profondeurs dans le passage des bauxites aux émeris: Acad. sci. Paris Comptes rendus, tome 223, p. 265–267, 1946 [French].

The present mineralogic study is not concerned with the change from one to another of the three main types of bauxite—gibbsitic, boehmitic, diasporic—but traces the diminution in water content due to metamorphism, starting with siliceous diaspore containing a small amount of iron. Siliceous diaspore characterized by the chlorite, daphnite, passes into samosite characterized by the chloritoid. A still lower water content is seen in the emery deposits of Turkey, in which diaspore is replaced by corundum, and the lowest in the stauritoid facies of the emery deposits of Naxos Island. Intrusion of granite in this area, by raising the isogeothermal gradient caused dehydration. A hydrothermal phase marks the end of metamorphism and produces a hydrate of alumina from the corundum. This then is deposited in cracks in the rocks as a new generation of diaspore or as gibbsite.

**Larín, A.**

La formación de yacimientas de aluminio y la posibilidad de fabricarlo en la Argentina: Rev. Minera, Geología, Mineralogía, tome 14, no. 3, p. 61–82, 2 figs., Buenos Aires, 1943 [Spanish].

This paper is a general review of the formation of laterite and bauxite deposits of economic importance in the world. Argentina has no deposits of bauxite, but the possibility of an aluminum industry in the country is studied.

**Launay, L. de.**

Bauxite, *in* Traité de métallogénie, tome 2, p. 233–239, 1 fig., Paris, Librarie Polytechnique, 1913 [French].

The section on bauxite is a brief general account of the types of bauxite and their mineral composition, and the deposits in France, Italy, Ireland, India, and the United States.

**Laur, Francis.**

The bauxites—A study of a new mineralogical family: Am. Inst. Min. Eng. Trans., v. 24, p. 234–242, 1894.

On the basis of physical and chemical properties, three general types of bauxite are recognized—hydrargillite (pure bauxite), siliceous bauxite, and ferruginous bauxite.

**Lazarević, M.**

1. Zu Tucan's Bauxitfrage: Centralbl. Mineralogie, Jahrg. 1913, p. 258–260, 1913 [German].

2. Nochmals zu Tucan's Bauxitfrage: Centralbl. Mineralogie, Jahrg. 1913, p. 600–601, 1913 [German].

These papers are a part of a controversy over the question of whether bauxite is a mineral or whether it is a rock consisting of several minerals in varying proportions. *See also* Tućan, 1913.

**Lebedeff, M. V.**

Une mission d'études géologiques et miniéres en Guyane-Inini: Annales mines Mém., sér. 13, tome 9, p. 5–22, 77–117, and 187–239, 6 figs., Paris, 1936 [French].

*Minerais d'aluminum, laterites, p. 218–221.*—In French Guiana those deposits of laterite which are the largest and most easily exploited are also the best quality;

those far from the coast are lower in grade. The laterites occur near the inner edge of the sedimentary series where it overlaps the ancient Guiana shield. It is an area of hills and plateaus with a general altitude of 20–25 meters. The high quality of the material is due to the relief which is favorable for the complete laterization of the aluminum-silicate rocks.

The bauxite deposits in French Guiana are more favorably located than those of Dutch and British Guiana, in that they are 30 kilometers or less from the coast.

**Legoux, Pierre.**

Esquisse géologique de l'Afrique occidentale française: Service mines Bull., no. 4, 134 p., 16 figs. (incl. sketch maps) and geol. map 1:5,000,000, Dakar, 1939 [French].

A general account of the geology and mineral resources of French West Africa includes the type and areal distribution of formations and the structural relations. The oldest formations are granite-gneiss, together with phyllite and other metamorphic rocks of Birrimian age which were folded during the Huronian tectonic period. The Paleozoic is represented by rocks of Cambro-Ordovician, Gothlandian, Devonian, and Carboniferous ages. During the Mesozoic, the area saw the Cenomanian transgression and later the Tertiary epicontinental sea. Vulcanism was pronounced in Senegal in the Tertiary and elsewhere in the Quaternary. Laterite is considered to have formed in the Quaternary. Among the mineral resources, the most important are gold, diamonds, titanium, zircon, phosphates, iron, bauxite, manganese, copper, and chromium. Bauxite occurs in four general areas: (1) the Kissen basin, (2) the Santa and Féfiné basins, (3) the Cogon and Lingourou basins, and (4) the Fatala basin. Bauxite also occurs overlying nepheline syenite on the Los Islands off the coast.

**Leiningen, Wilhelm Graf zu.**

Die Roterde als Lösungsrest mariner Kalkgest: Chemie der Erde, Band 4, Heft 2, p. 178–187, 1930 [German].

It is considered that the roterde or terra rossa which occurs on limestone in karst regions, as along the Adriatic coast, is an accumulation of the insoluble residue from the weathering of the limestone and is not material transported from other regions. Chemical analyses of roterde from a number of places in the Adriatic and of the insoluble residue from samples of limestone are included for comparison. They are similar in alumina, silica, and iron contents, and indicate the presence of aluminum silicates and iron oxides. The roterde under consideration is a red soil which is not bauxitic, nor is the problem of the formation of bauxite touched upon.

**Lemoine, Paul.** *See* Chautard, Jean.

**León, Juan Calafat.** *See* Calafat León, Juan.

**Levando, Ye.**

(Isotherm of elasticity of vapor in the bauxites from the Tikhvin bauxite deposit): Leningrad. geol.-gid.-geolez. tresta Izv., tom 4–5, p. 34–42, 1934 [Russian, English summary].

The amount of moisture given off and the effects of varying vapor pressures were studied in 12 samples of bauxite from the Tikhvin deposits.

**Li, Chingyuan Y.**

(and Hsieh, C. Y.). Potential sources of aluminum in southwestern China: Min. Technology, v. 10, no. 1, Am. Inst. Min. Metall. Eng. Tech. Pub. 1938, 6 p., 2 figs., 1946.

The possible sources of aluminum in China are taken to be bauxite, alumina-rich shales, and alunite. Bauxite was first recongized in China at Paoshan, Shantung Province. Reserves are estimated to be about 271 million tons of diaspore clays. Bauxite has also been discovered in Kweichow Province where it is about 26 feet thick lying between Ordovician dolomitic limestone and the Lower Carboniferous coal series. In Yunnan Province the bauxite occurs between Devonian and Lower Carboniferous rocks; these deposits may consist primarily of the mineral boehmite; reserves are estimated to be more than 10 million tons. Bauxite also occurs in Szechuan Province. Large deposits of alunite are known to occur along the southeastern coast of China. Reserves by localities are included. High-alumina shale occurs in northeastern China in Manchuria. Reserves amount to 110 million tons of material having 50 percent alumina.

**Libbey, Fay Wilmott.**

1. (and Lowry, Wallace Dean, and Mason, Ralph S.). Preliminary report on high alumina iron ores in Washington County, Oregon: Oreg. Dept. Geol. Min. Indus., G. M. I. Short Paper 12, 23 p., 8 figs. (incl. index and topog. maps), 1944.

Bauxitic iron ore in scattered deposits in four townships in Washington County is announced in this preliminary paper. The material analyzes about 25 percent iron, 30 percent alumina, and 0.15 percent phosphorous: it is oolitic or pisolitic in texture, and magnetic. The deposits are 6–15 feet thick and occur on flat-topped hills and spurs. The ore is lateritic and was apparently formed by the weathering of the Columbia River basalts of Miocene age.

2. (and Lowry, Wallace Dean, and Mason, Ralph S.). Ferruginous bauxite deposits in northwestern Oregon: Oreg. Dept. Geol. and Min. Indus. Bull. 29, 98 p., 2 pls., 15 figs. (incl. index and topog. maps), 1945.

Ferruginous bauxite deposits occur in northwestern Oregon, principally in Washington, Columbia, and Marion Counties. The deposits were formed by the laterization of Miocene basalts before deposition of Pliocene(?) silts and probably before the gentle folding and uplift of the region. Erosion has removed a large part of the laterized flows, so that the deposits remaining cap flat-topped hills and gentle slopes. The thickness ranges from 6 to 20 feet and appears to be greater in the northern part of the area. The texture is usually oolitic, but this seems to be less common in the south. More than 5 million long tons of this material is estimated to occur in Washingtoun County alone. Averages of analyses show 34.68 percent $Al_2O_3$, 23.12 percent iron, 9.48 percent silica, 4.85 percent titania, and 0.176 percent phosphorus.

3. (and Lowry, Wallace Dean, and Mason, Ralph S.). Ferruginous bauxite deposits in northern Oregon: Econ. Geology, v. 41, no. 3, p. 246–265, 9 figs. (incl. index map), 1946.

The ferruginous bauxite deposits of northwestern Oregon were formed by laterization of Miocene basalts before deposition of the overlying Pliocene silts, and probably before the Pliocene folding and uplift. The deposits occur on flat-topped hills or gentle slopes. The texture of the upper part of the deposits is commonly oolitic, whereas the lower part is earthy to nodular. Exploration of large deposits in Washington County has indicated 5 million long tons averaging 34.68 percent alumina, 23.13 percent iron oxide, 4.85 percent titania, 9.48 percent silica, and 0.176 percent phosphorus.

**Libman, E. P.**

[Mineral resources of the U. S. S. R.—Aluminum and bauxite]: Moscow, 39 p., 1932 [Russian].

[Not available for annotation or checking.]

**Liebrich, Adolf von.**

1. Bauxit: Oberhess. Gesell. Natur- u. Heilkunde, Ber. 28, p. 57–98, 6 figs. (microphotos.), Giessen, 1892 [German].

Bauxite in the Vogelsberg, Germany, area, overlies and is a weathering product of basalt. Samples of claylike material were collected from (1) near Garbenteich, (2) Lich, (3) southwest of Villingen, (4) at Villingen, and (5) east of Firnewald. Clays 1, 2, and 5 show horizons of bauxite as well as high-iron material. Clay 3, especially the friable type, cannot be designated either bauxite or weathered basalt. Clay 4 is not bauxite but is an ironstone. The geologic location, appearance, and chemical analyses of clay from these five localities are described in detail. The studies indicate that in the bauxite, hydrargillite (gibbsite) forms crystals as long as 0.1 millimeter, which occur in small openings in the deposit, and that the bauxite of the Vogelsbergs retains a feldspar-basalt texture.

2. Beitrag zur Kenntnis des Bauxits vom Vogelsberge: Inaud. Diss. Zürich-Giessen, 1894(?); abs. Zeitschr. Krystallographie, Band 23, p. 296, 1894 [German].

3. Bauxit und Smirgel: Zeitschr. prakt. Geologie, Jahrg. 1895, p. 275–277; Oberhess. Gesell. Natur- und Heilkunde Ber. 30, p. 19–23, 1 fig., Giessen, 1895 [German].

The main differences between bauxite and emery are (1) the relative difference in water content and (2) the existence of ferrous iron oxide in the emery.

4. Über die Bildung von Bauxite und verwandte Mineralien: Zeitschr. prakt. Geologie, Jahrg. 1897, Heft 6, p. 212–214 [German].

The mode of formation of bauxite and other aluminum-bearing minerals is discussed. The silicate-free minerals fall into the following groups: (1) sulfates, (2) hydrates, (3) phosphates, arsenates, and borates, (4) organic compounds, (5) fluorides, (6) oxides, and (7) aluminates. As the type of rock underlying bauxite is not everywhere known, far-reaching conclusions as to the origin of bauxite were not attempted. In the Vogelsberg, it is a basalt, and here the presence of pyrite makes possible the theory of the action of sulfate-bearing waters on silicates with the subsequent precipitation of aluminum hydrate.

**Lienau, H.**

1. Der Bauxit: Electrochem. Zeitschr., Band 9, p. 101–104, Berlin, 1902 [German].

2. Feuchtigkeit und Konstitutionswasser im Bauxit: Chemiker-Zeitung, Jahrg. 29, Abt. 1, no. 99, p. 1280–1281, 1905 [German].

On the basis of water content, bauxites are divided into the diaspore group and the bauxite group. Many analyses of French bauxites are included.

**Litchfield, Lawrence, Jr.**

1. The bauxite industry of northern South America: Eng. Min. Jour., v. 128, no. 7, p. 243–248, 5 figs. (incl. index map), 1929.

The geology, major topographic features, population, and development of the natural resources, especially the bauxite deposits, is given for British and Dutch Guiana as a unit insofar as possible. Enormous resources of bauxite are known in the area. Washed ore from British and Dutch Guiana are respectively about

61 and 59 percent alumina, 2.5 and 2.0 percent silica, and 2.5 and 6.0 percent iron oxide, 3.0 percent titania, and 31 and 30 percent water.

2. Bauxite mining in Dutch Guiana: Eng. Min. Jour., v. 128, no. 12, p. 461–464, 6 figs., 1929.

Prospecting for bauxite in Dutch Guiana began in 1916. In 1922, the first ore was shipped by the Surinaamsche Bauxite Maatschappij, still the most important producer in 1929. The town of Moengo was built to house company employees. By 1927, washing and drying plants also had been constructed. The mining methods used at the Moengo Hill deposit, and the washing, drying, and shipping of the ore are described.

3. Bauxite: Chem. Industries, v. 48, pt. 1, p. 154–159, 8 photos.; pt. 2, p. 290–295, 1 fig., 5 photos., 1941.

A general résumé of information on bauxite. Part 1 includes a brief history of the discovery of the mineral in France and the United States, and of the process for manufacturing aluminum. The chemical and mineralogic composition and physical properties of bauxite are shown to vary greatly. The necessary and desirable composition and physical properties of bauxite are given for the main commercial uses—the manufacture of aluminum, abrasives, chemicals, and cement, and for oil purification—and minor uses. In part 2, statistics on production include total production, 1904 through 1939, by countries. Types of deposits, grade and kind of ore, mining process, and prices of ore in the important producing countries are discussed briefly. Data of consumption and production in the United States include statistics for 1935–1939.

**Loewinson-Lessing, F.**

L'aimantation comme méthode rapide de déterminer sur le terrain la teneur en fer des bauxites: Akad. nauk USSR Doklady, no. 16–17, p. 301–302, 1928 [Russian, English summary].

"The author suggests that artificial magnetisation might be made use of as a method of quick approximate determination of the content of ferric oxide in bauxites, perhaps also in certain clays and in limonite ores. The data for a series of bauxites are given in the table above."—*English summary.*

**Lotti, Alfredo.**

Ipotesi sulles relazioni de origine de saldame, della bauxite e de alcuni minerali ferrosi in Istria: Industria mineraria, anno 14, no. 1, p. 1–5, Rome, 1940 [Italian].

The relationship between bauxite deposits of Istria and the associated sands and limonite are discussed. Bauxite occurs in Upper Cretaceous limestone between Albona and Pisino. The bauxite lies directly on the limestone but is overlain by sandy bauxite and sand. The bauxite varies considerably in chemical composition from ore high in silica to ore high in iron. Where iron is present in unusually high percentages, silica tends to be low; the reverse of this was also noted. The factors controlling movement and concentration of iron are discussed.

**Lotti, B.**

1. Über des Bauxitlager von Colle Carovenzi nahe Pescosolido: Rassegna mineraria, v. 18, no. 11, p. 163–165, 1903; abs., Zeitschr. Krystallographie, Band 41, Heft 3, p. 279, 1906 [German].

Bauxite deposits in the Colle Carovenzi area, Italy, overlie limestones of Urgonian age. The bauxite is a red-brown mottled color. Chemical analysis of one sample shows 58.40 percent alumina, 24.83 percent iron oxide, and 2.52

percent silica. It is considered that bauxite and oolitic iron ore are genetically related.

2. Ostungarische und italienische bauxite: Zeitschr. prakt. Geologie, 16 Jahrg., p. 501–504, 1 fig., 1908 [German].

The characteristics of the bauxite deposits of eastern Hungary and Italy are compared. The deposits of the Bihar Mountains, eastern Hungary [now Rumania] directly overlie Jurassic limestone and are overlain by Late Cretaceous clastics. The bauxite is red-brown and pisolitic. The Italian deposits of the Abruzzi region, on the other hand, are interbedded with limestones of upper Cenomanian and lower Turonian ages (early Cretaceous), and are red-brown and oolitic. Characteristic of the latter limestones is the small fossil *Requienia* species.

**Lowry, Wallace Dean.** *See* Libbey, Fay Wilmott, *and* Wilkinson, W. D.

**Lubig, Mary R.**

1. Bauxite in Surinam: U. S. Dept. Commerce, World Trade, v. 8, pt. 23, no. 5, 7 p., April 1950.

This paper is a comprehensive review of the bauxite industry in Surinam. This country is the leading bauxite producer in the world. Known reserves have been estimated at 50 million tons. The mining companies, properties, mining methods, labor, and production are discussed. Chemical analyses of typical shipments show about 56 percent alumina and about 2 percent silica.

2. Bauxite in British Guiana: U. S. Dept. Commerce, World Trade, v. 8, pt. 23, no. 8, 4 p., May 1950.

Bauxite deposits in British Guiana occur in the Coastal Plain region about 60 to 70 miles inland. They range from a few feet to 30 feet in thickness. The mining companies, mining methods, and properties are described, giving a complete picture of the economic situation. Production, import, and export figures include the years 1917 to 1948.

3. Bauxite in France: U. S. Dept. Commerce, World Trade, v. 8, pt. 23, no. 11, 7 p., June 1950.

The changed economic picture of the bauxite industry in France is discussed. The important producing centers are in Var, Hérault, Ariège, and Bouches-du-Rhône. Analyses of the white, gray, and red ores and their sub-types are included in a table. Production from 1920 to 1945 by Departments, exports, etc. are also shown on tables.

**Ludrook, N. H.** *See* Gardner, D. E.

**Lutaud, L.**

Observations sur la relations tectonique de la bauxite aux environs de Brignoles (Var): Soc. géol. France Comptes rendus, Ann. 1926, fasc. 4, p. 51–53, 1926 [French].

The bauxite had been thought to occur between dolomite of Jurassic age and limestones of Santonian (Late Cretaceous) age. However, more recent studies of a shallow syncline in the vicinity of Brignoles showed an almost complete absence of bauxite at this horizon and also indicated the relation of the bauxite to rocks of Senonian (Late Cretaceous) age.

**Luyken, W.**

Über Versuche zur Anreicherung von Ungarischen Bauxit: Metall u. Erz, 39 Jahrg., 1942 [German].

**Luz, A.**

Laterit, seine Betrachtung im Lichte der Kolloidchemie: Kolloid-Zeitschr., Band 14, Heft 2, p. 81–90, 1914 [German].

A study of the probable chemical reactions and crystallization from colloids in the weathering of aluminum-silicate to hydrargillite and diaspore includes a review of the work of a number of German scientists. Although the question is not settled, presumably aluminum silicates weather to colloidal silicates and loose the alkalies. During a second stage the colloidal silica is removed. From the alumina gel, crystal forms develop.

**Lyamina, A. N.**

Rentgenograficheskoy issledovaniye dafnita Ivdel'skogo mestorozhdeniya na Severnam Urale (An X-ray investigation of daphnite of the deposit in the North Urals), *in* Boxity, tom 3 (Bauxites, v. 3): Vses. nauch.-issledov. inst. mineral'nogo syr'ya Trudy, vyp. 120, p. 29–35, 69, 1 fig., 3 pls., Moscow-Leningrad, 1938 [Russian, English summary].

Chlorite is known to be an isomorphous compound following the Vegard law of additivity. Chemical analysis shows the Ivdel chlorite to have the formula: 93.53 percent (Am+Dn) and 6.47 percent (Sp+FeSp). The formula has been verified by x-ray. Thus, the cholorite mineral is shown to be daphnite.

**Lyubimov, I. A. (Lubimov).**

Hypergenic process in formation of the bauxites from the Petropavlovsk district: Akad. nauk SSSR Izv., Ser. geol., no. 4, p. 25–34, Moscow, 1942 [Russian, English summary].

In the Petropavlovsk district, U. S. S. R., friable bauxite occurs in pits and crevices in limestone of Silurian age. These cavities are thought to have been formed by the action of sulfuric acid produced by the disintegration of pyrite.

**McBride, R. S.**

Aluminum and bauxite: Mineral Industry, 1926, v. 35, p. 11–47, 1927.

Statistics on domestic bauxite production by States, imports, and consumption include the years 1916–26. World production by countries is given, 1920–26. The Blanc process and the Pederson process for the production of alumina are explained briefly.

**McCalley, Henry.** *See also* Smith, Eugene A.

1. Alabama bauxite: Ala. Indus. Sci. Soc. Proc., v. 2, p. 2–32, 1892. Abs. Science, v. 20, p. 303–304, 1892; Eng. and Min. Jour., v. 54, p. 584, 1892.

In Alabama, bauxite was first discovered in 1889 in Cherokee County; within a few years many other deposits were also discovered in this part of the State. The known deposits and mines in the area are described in detail. Mining companies are listed.

2. Bauxite: Mineral Industry, 1893, v. 2, p. 57–68, 1894.

This report gives an account of the physical and chemical characteristics of bauxites, together with many analyses, and describes the geologic and geographic occurrence of the bauxite deposits of the world. It also names operating companies and mines in the United States and contains statistics on domestic production and imports of bauxite and short sections on uses and markets.

3. Bauxite mining: Science, v. 23, no. 572, p. 29–30, 1894.

Until 1894, four companies had mined bauxite in northern Georgia-Alabama: the Republic Mining and Manufacturing Co., the Southern Bauxite Mining

and Manufacturing Co., the Georgia Bauxite Co., and the John D. Taylor Bauxite Co. The mines, like the manganese and limonite mines, are "irregular holes, diggings in the ground, on the sides of hills, with deep, open drainage channels, or ditches, leading off from them and with graded ways leading down into them." The names, locations, and brief descriptions of producing and closed mines in the Georgia-Alabama district and the names of the owners are given.

4. The valley regions of Alabama (Paleozoic strata): Ala. Geol. Survey Special Rept. 9, pt. 2, 862 p., 1897.

*Pages 79–84.*—The bauxite deposits of northeastern Alabama are briefly described.

**McCallie, S. W.**

1. A preliminary report on the mineral resources of Georgia: Ga. Geol. Survey Bull. 23, 208 p., 20 pls., 2 maps, 1910.

*Bauxite, p. 39–59.*—The bauxite deposits of Georgia occur at two geologic horizons—in Paleozoic rocks of northwestern Georgia, and in Tertiary rocks of Wilkinson County. Chemical analyses show some silica, but are low in iron. Mining is by opencuts or pits and shafts, and the ore is raised by steam hoists or derricks. Most of it is dried before being shipped. In 1910 the bauxite was used almost exclusively in the manufacture of alum and aluminum.

2. Bauxite deposits of southern Georgia: Eng. Min. Jour., v. 91, p. 1050, 1 fig., 1911.

The bauxite deposits of eastern Wilkinson County were discovered by Otto Veatch in 1906. The deposits appear to occur as pockets or blankets which are widely but sparsely distributed and are closely associated with white clays of Cretaceous age. The bauxite is pisolitic, concretionary, or amorphous. Chemical analyses show an average of about 52 percent $Al_2O_3$. The first mining was started in 1910 by the National Bauxite Company.

**McCutcheon, Thomas Edwin.** *See also* Conant, Louis Cowles; Mellen, Frederic Francis; *and* Priddy, Richard Randall.

**McHenry, A.** *See* Cole, Grenville, A. J.

**McIntosh, Frank K.**

Investigation of Hamilton County bauxite district, Tennessee: U. S. Bur. Mines Rept. Inv. 4550, 31 p., 7 figs., 1949.

The bauxite deposits of Hamilton County, Tenn., occur in three general areas: the Summit Knob, south Missionary Ridge, and north Missionary Ridge areas. A drilling program was conducted from November 1942 until March 1943. A total of 2,519.5 feet in 38 holes was drilled on three properties. Bauxite was discovered in the district in 1906 and was mined until 1928; the mine workings now consist of caved shafts and pits. The deposits are found filling old sink holes in the Copper Ridge dolomite. Logs of all holes are appended.

**Maclaren, Malcolm.**

On the origin of certain laterites: Geol. Mag., decade 5, v. 3, p. 536–547, 2 figs., 1906.

The author concludes: (1) that the formation of laterites requires tropical heat, vegetation, and alternate wet and dry seasons; (2) that their distribution in India marks ancient or existing basins or plains; (3) that they are derived from "mineralized solutions brought to the surface by capillarity, and are essentially replacements * * * of soil or rock decomposed in situ"; and (4) that in India a sub-

sequent change in laterites is toward greater hydration, not dehydration as has been suggested for other areas.

**McManamy, L.** *See* Stewart, D. R.

**MacNeil, F. Stearns.**

Summary of the Midway and Wilcox stratigraphy of Alabama and Mississippi: U. S. Geol. Survey Strategic Minerals Inv. Prelim. Rept. 3–195, 29 p., 1 pl. (showing 103 correlated sections, an index map, and correlation chart), 1946.

In the broad arc extending from northern Mississippi into eastern Alabama, the stratigraphic units of the early Tertiary Midway and Wilcox were redefined and recorrelated as a stratigraphic study in connection with bauxite investigations. Conclusions were summarized: (1) Bauxite occurs in lenticular clays in a nonmarine facies of the Nanafalia formation (early Wilcox age) in eastern Alabama and western Georgia; and in Mississippi in nonmarine clays of the basal Fearn Springs sand member of the Wilcox formation, in the Betheden formation (between the top of the marine Midway and the basal Wilcox sands), and also in places in the upper part of the Porters Creek formation. (2) The approximate position of the strand line in Nanafalia time is shown on the map; bauxite deposits only occur on the landward side of this line. (3) No bauxite or bauxitic clay in the region occurs in beds younger than early Wilcox.

**MacPherson, Frank H.**

Wartime bauxite mining in Arkansas: Min. Technology, v. 9, no. 5, Tech. Pub. 1910, 17 p., 4 figs., Sept. 1945.

The history of the wartime bauxite mining in Saline and Pulaski Counties, Ark., includes names of the mining companies, new plants constructed, and mine production, 1935–43. The types of bauxite, uses, grade of ore by industries, methods of exploration, open-pit and underground mining operations, War Production Board classification of ore, activities of the Metals Reserve Company, and reserves are discussed succinctly.

**McQueen, H. S.** *See also* Stewart, D. R.

(and Herold, Paul C.) Geology of the fire clay districts of east central Missouri: Mo. Geol. Survey and Water Res., v. 28, 2d. ser., 250 p., 6 figs., 39 pls., 1943.

The fire clays of east-central Missouri occur in the Cheltenham formation of Pennsylvanian age. The clays are variable and grade into one another, but have been classified as plastic to semi-flint, flint fire, burley, and diaspore clays. The most important use of these clays is in the manufacture of high-grade fire brick and other refractories, but certain grades are also used as a paper filler, for stoneware, and in the chemical industry. The diaspore clays contain a minimum of 70 percent alumina. The geology of the area and the physical and chemical characteristics of the clays are described in detail.

**Maffei, F. J.**

(and Souza Santos, Tharcisio de). Contribuição para o estudo da bauxita do Planalto de Poços de Caldas: Inst. Presquisas Technol. São Paulo, Bol. 17, p. 109–134, 9 pls., 1937 [Portuguese].

Bauxite deposits of the Poços de Caldas plateau overlie nepheline syenite which is intrusive into Archaean and younger sedimentary rocks. The area had been eroded to a peneplain by Eocene time and was uplifted probably at the end of the

Pliocene. The deposits were formed by laterization (defined as the alteration of previously kaolinized rocks in regions of little relief and tropical climate, with the concentration of alumina and outward migration of other constituents). Chemical analyses of foyaite, phonolite, and bauxite are included. Bauxite runs 59–65 percent $Al_2O_3$, 0.74–6.9 percent $SiO_2$, 0.6–6.2 percent $Fe_2O_3$, 0.5–1.4 percent $TiO_2$, and 28–33 percent $H_2O$. Thermal dehydration curves show that the alumina occurs almost exclusively as gibbsite.

**Maggiore, L.**

Il Matese metallifero: Industria mineraria, anno 12, no. 7, p. 235–246, 8 figs., Rome, 1938 [Italian].

The general geology and mineral resources of the Matese area, Italy, are described. Bauxite is the most important ore. The deposits are discontinuous and variable in size and composition. The variation in grade is shown by chemical analyses, the highest and lowest of which are about 77 and 53 percent alumina, 5 and 26 percent iron, 5 and 6 percent silica plus titania, and 13 and 11 percent water. The potentialities of the area are discussed.

**Maitland, A. Gibb.**

The bauxite deposits (aluminous laterite) of Western Australia, *in* The Mining Handbook: Western Australia Geol. Survey Mem. 1, p. 3–5, Perth, 1919.

**Maksimovich, G. A. (Maximovich).**

1. Aktai-Talitsa deposits of bauxite: Molotov. gosudar. univ. Uchenye zapiski, v. 2, no. 3, p. 263–299, 1 fig. (geol. map), 1936 [Russian, English summary].
2. Gidrogeologiya i karstovyye yavleniya rayona Aktaysko-Talitskogo mestorozhdeniya boksita [Hydrogeology and karst phenomena of the Aktai-Talitsa bauxite deposit]: Razvedka Nedr, nos. 9–10, p. 38–41, sketch map, Moscow, 1937 [Russian].

**Malamphy, Mark C.** *See also* Thoenen, John R.

1. (and Vallely, James L.) Geophysical survey of the Arkansas bauxite region: Geophysics, v. 9, no. 3, p. 324–366, 5 pls., 15 figs. (incl. geol. and magnetic maps), 1944.

Magnetic and gravimetric surveys over an area of about 1,400 square miles in the bauxite district in Arkansas indicated the presence of 10 previously unknown syenite domes, later proved by drilling. Only 2 of these domes projected above the buried Midway-Wilcox contact—a condition requisite for the formation of bauxite. The geophysical data also indicated the configuration of the buried flanks of the known syenite outcrops. Magnetic surveys along the Midway-Wilcox contact between Gordon and Searcy showed the improbability of the existence of other syenite masses similar to those in the bauxite district.

2. (and Dale, George K., Romslo, T. M., Reed, A. H., Jr., Ollar, A., and [v. 1, only] Tracey, J. I., Jr.) Investigation of Arkansas bauxite, volumes 1 to 18: U. S. Bur. Mines Rept Inv. 4251–4268, 1,836 p., 123 figs., 1948.

The results of an investigation of the bauxite resources of Saline and Pulaski Counties, Ark., from December 1941 to May 1945 are presented in 18 volumes. The first volume contains information on the area as a whole; the following 17 voumes gives the results of drilling in specific areas. Generally, each volume covers the geology, wildcat and other drilling, the location and brief description of ore bodies found, and logs of the drill holes, together with chemical analyses of the cores, of the area of one-half a township. (The results of drilling in the N½,

T. 1 S., R. 12 W., however, extend through 3 volumes; and several others, through two volumes.)

Open-pit, underground, and shaft mines in the area are described. The first underground mining began in 1923 by running a drift in from the lower end of an open-pit mine. The first vertical shaft was sunk in 1927 to a depth of about 100 feet.

A résumé of the geophysical survey conducted by the Bureau of Mines is included, together with maps showing the anomalies (see Malamphy, 1944). A section on geology of the district was written by Tracey.

The laboratory procedure for the analysis of the bauxite and clay samples is given in detail.

The types of drill rigs used are described, and the performance evaluated.

**Malyavkin, S. F. (Maliavkin).**

Alyuminiy i boksit (Alumina and bauxite): U. S. S. R., Geol. kom., Obzor mineral'nykh res. SSSR, pt. 4, 89 p., Leningrad, 1927 [Russian, only title in English].

**Mankovsky, W.**

Notes on a graphical method for the approximate determination of alumina and water in a Gold Coast deposit: Inst. Mining and Metallurgy Bull. 475, 10 p., 3 figs., 1945.

A simple method of determining silica, iron, alumina, and water in a bauxite sample is based on the relation between the constituents so that straight-line graphs are obtained if $Fe_2O_3$ is plotted against either $Al_2O_3$ plus $TiO_2$ or $H_2O$. Graphs were also drawn showing the $Fe_2O_3/SiO_2$, the $Fe_2O_3/Al_2O_3$ and the $Fe_2O_3/H_2O$ relationships.

**Mantell, C. L.**

1. Aluminum and bauxite: Mineral Industry, 1928, v. 37, p. 12–27, 1929.

Statistics on domestic bauxite production by States, imports, exports, and consumption include the years 1918–28. World production by countries is given, 1922–28, and also brief notes on the bauxite mining areas and undeveloped deposits in foreign countries.

2. Aluminum and bauxite: Mineral Industry, 1929, v. 38, p. 14–30, 1930.

Statistics on domestic bauxite production by States, imports, exports, and consumption include the years 1919–29. World production by countries is given, 1923–29, and also brief notes on the bauxite mining areas, undeveloped deposits, and operating companies in the United States and other countries.

3. Aluminum and bauxite: Mineral Industry, 1930, v. 39, p. 13–37, 1931.

Statistics on domestic bauxite production by States, imports, exports, and consumption include the years 1920–30. World production by countries is given for 1924–30. Brief notes on the mining areas, undeveloped bauxite deposits, and operating companies in foreign countries are included.

4. Aluminum and bauxite: Mineral Industry, 1931, v. 40, p. 15–33, 1932.

Statistics on domestic bauxite production by States, imports, exports, and consumption include the years 1922–31. World production by countries is given 1925–31, and also brief notes on bauxite mining areas and operating companies in the United States and foreign countries.

5. Aluminum and bauxite: Mineral Industry, 1932, v. 41, p. 13–29, 1933.

Statistics on domestic bauxite production by States, imports, exports, and consumption include the years 1923–32. World production by countries is given

1926–32, and also brief notes on bauxite mining in the United States and foreign countries.

6. Aluminum and bauxite: Mineral Industry, 1933, v. 42, p. 13–31, 1934.

Statistics on domestic bauxite production by States, imports, exports, and consumption include the years 1924–33. World production by countries is given, 1927–33, and also brief notes on bauxite mining in the United States and foreign countries.

7. Aluminum and bauxite: Mineral Industry, 1934, v. 43, p. 13–35, 1935.

Statistics on domestic production of bauxite by States, imports, exports, and consumption include the years 1925–34. World production by countries is given, 1927–34. Statistics on the bauxite consumed by the industries are broken down for 1925–34. Brief notes on bauxite mining in the United States and foreign countries are included.

8. Aluminum and bauxite: Mineral Industry, 1935, v. 44, p. 13–30, 1936.

Statistics include: domestic production of bauxite by States, imports, exports, and consumption, 1926–35, world production of bauxite by countries, 1928–35; and tonnages of bauxite consumed by the various industries, 1926–35. Brief notes on bauxite mining in the United States and foreign countries are given.

9. Aluminum and bauxite: Mineral Industry, 1936, v. 45, p. 13–30, 1937.

Statistics include: domestic production of bauxite by States, imports, exports, and consumption, 1927–36; world production of bauxite by countries, 1929–36; and tonnages of bauxite consumed by the various industries, 1927–36. Brief notes on bauxite mining in the United States and foreign countries are given.

10. Aluminum and bauxite: Mineral Industry, 1937, v. 46, p. 37–51, 1938.

Statistics include: domestic production of bauxite by States, imports, exports, and consumption, 1928–37; world production by countries, 1930–37; and tonnages of bauxite consumed by the various industries, 1928–37. Brief notes on bauxite mining in the United States and foreign countries are given.

11. Aluminum and bauxite: Mineral Industry, 1938, v. 47, p. 7–28, 1939.

Statistics include: domestic bauxite production by States, imports, exports, and consumption, 1929–38; world production by countries, 1931–38; and tonnages of bauxite consumed by industries, 1929–38. Brief notes on bauxite mining areas, and operating companies in the United States and foreign countries are given.

12. Aluminum and bauxite: Mineral Industry, 1939, v. 48, p. 7–27, 1940.

Statistics include: domestic bauxite production by States, imports, exports, and consumption, 1930–39; world production by countries, 1932–39; and consumption of bauxite by various industries, 1930–39. Brief notes on undeveloped bauxite deposits, bauxite mines, and operating companies in foreign countries are given.

13. Aluminum and bauxite: Mineral Industry, 1940, v. 49, p. 7–28, 1941.

Statistics include: domestic production of bauxite by States, imports, and consumption, 1931–40; world production by countries, 1933–40; and domestic bauxite consumption by industries, 1931–40. Brief notes on bauxite deposits, bauxite mines, and operating companies in the United States and foreign countries are given.

14. Aluminum and bauxite: Mineral Industry, 1941, v. 50, p. 5–32, 1942.

Statistics include: domestic production of bauxite by States, imports, exports, and consumption, 1937–41; world production by countries, 1934–41; and domestic bauxite consumption by industries, 1932–41. Bauxite mining in the United States and foreign countries is discussed.

**Maranelli, Adolfo.**

I giacimenti bauxitici del Sannio: Soc. naturalisti Boll. 50, p. 183–193, Naples, 1940 [Italian].

The two bauxite districts near Sannio, Italy, are the Taburno and the Matese. The second is of the greater economic importance and is described in detail.

**Marbut, C. F.**

Morphology of laterites: Internat. Cong. Soil Sci., 2d Cong., Leningrad-Moscow, 1930, Comm. 5 Proc. and Papers, p. 72–80, 1932.

Soil profiles in Cuba and the Amazon valley are described. It is concluded that normal laterites do not have an indurated iron layer and are developed where there is free drainage and no high ground water table; the concentration of iron and alumina is merely a residual accumulation from which the silica and alkalies have been removed; segregation of sesquioxides as concretions may or may not occur; iron oxide occurs as indurated accumulations at the surface of the ground water table, and the thickness of the zone of accumulation is the width of the zone of fluctuation of the water table; therefore alternate wet and dry seasons are possibly not necessary in the formation of laterites.

**Mariani, Ernesto.**

La bauxite nella Penisola Salentina e nel Promontorio del Gargano: R. inst. lombardo sci. Rend., ser. 2, v. 63, fasc. 1–10, p. 535–540, 1930 [Italian].

The bauxite deposits of central Italy contrast with those of the Istrian Peninsula in topography, stratigraphy, and in structural control. The differences are pointed out in detail. Production of bauxite and aluminum in Italy and the principal uses of bauxite are also discussed.

**Markova, N. G.**

(and Shtreys, N. A.). Issledovaniye paleozoyskikh boksitov vostochnogo sklona Urala i stratigrafiya vmeshchayushchikh ikh tolshch (A study of the Paleozoic bauxites of the eastern slope of the Urals and the stratigraphy of the enclosing beds), *in* Boksity, tom 2—Mestorozhdeniya boksitov, priurochennyye k paleozoyskim otlozheniyam (Bauxites, v. 2—Bauxite deposits confined to the Paleozoic): Vses. nauch.-issled. inst. mineral'nogo syr'ya, Trudy, vyp. 112, p. 3–50, 6 pls. (geol. maps), Moscow-Leningrad, 1936 [Russian, English summary].

Bauxite deposits of Paleozoic age occur along the eastern slope of the Urals in a narrow band extending from Ivdel southward to the Verkhne-Turindky plant. The deposits are found at two strigraphic horizons: in the Ludlow group of the Upper Silurian, and in Coblentzian in the Lower Devonian. The bauxite is underalin by a bauxite breccia and overlain by clays, bauxite, and limestone. It is considered that, because of the bedded structure of the deposits and the uniform thickness, the bauxite was formed under marine conditions.

**Markovskiy, A. (Markovskii).**

O nakhodke boksitovykh obrazovaniy v Turkestanskom khrebte [On the discovery of bauxite deposits in the Turkestan Ridge]: Tsentral'nyy Nauch.-issled. geol.-razved. inst., Materyaly, sbornik 2, p. 45–48, Moscow-Leningrad, 1935 [Russian]; abs., Neues Jahrbuch, Referate II, Band 2, p. 187–188, 1936 [German].

Bauxite deposits discovered about 25 kilometers south of Ura-tjube in the Turkestan Ridge are briefly described. Chemical analyses show 52.59 percent alumina, 15.97 percent silica, and 17.23 percent iron oxide.

**Marquardt, C. M.**

Magnetic prospecting in metal mining: Min. Jour. v. 23, no. 4, p. 3–4, Phoenix, Ariz., 1939.

The applicability of a magnetic survey to mining is discussed. The iron ore areas of Michigan, Wisconsin, and Minnesota, and the bauxite area in Arkansas are used as examples.

**Martin, F. J.**

1. (and Doyne, H. C.). Laterite and lateritic soils in Sierra Leone: Jour. Agr. Sci. v. 17, p. 530–547, (London), 1927.

Chemical analyses of the sand, silt, clay, and other fractions of the laterites and lateritic soils of Sierra Leone are given and field relations described. It is suggested that in soil classification, the silica-alumina ratio of the clay fraction be used, and if the ratio of this fraction is below 1.33, the material be called laterite; if between 2.0 and 1.33, lateritic.

2. (and Doyne, H. C.). Laterite and lateritic soil in Sierra Leone, II: Jour. Agr. Sci. v. 20, pt. 1, p. 135–143, London, 1930.

The western part of the Sierra Leone Peninsula is underlain by norite, which weathers to laterite. Studies of the residual laterite crust include chemical analyses and mineralogy of the norite, the bauxite, and the intermediate weathering products. Chemical analyses of detrital laterites here, in general, show a higher proportion of alumina to silica than do the residual laterites. The lateritic soils in the area were found to remove phosphorus from a water solution.

**Mason, Ralph S.** *See* Libbey, Fay Wilmott.

**Mattirolo, E.**

Bauxiti italiane: Rassegna min., v. 14, p. 229, 1901.

**Masel, V.**

[Aluminum production in the U.S.S.R.]: [Russia, Govt. Sci. and Tech. Publishing Office for Ferrous and Non-ferrous Metallurgy (Leningrad-Moscow)], 300 p., 119 figs., 1940 [Russian. Citation in Russian not available.]

**Mattson, Sante.**

The laws of soil colloidal behavior; IX.—Amphoteric reactions and isoelectric weathering: Soil Sci., v. 34, no. 3, p. 209–240, 5 figs., 1932.

In a soil complex, if an insoluble weak base reacts with a weak acid to form insoluble compounds, these compounds will contain acid and basic residues of varying strength and react amphoterically. Where the acid residue is weak, the isoelectic point will be high, and where it is strong, the pH will be low. In general, amphoteric compounds are "least dispersible, least soluble, and least ionized, and therefore most stable, at their isoelectric point." Therefore, under conditions of heavy leaching the tendency would be for the formation of an isoelectric soil complex. In humid temperate regions where there is an abundance of humus in the soil, the pH will be low and favor the accumulation of a high-silica colloid fraction. Where the pH is higher, as in tropical regions where there is little humus in the soil, the aluminum silicates become "more highly hydrolyzed, that is, the silicate ions are displaced by OH, resulting in a liberation, dispersion, and solution of silica." However, the rainfall must be heavy enough to remove the strong bases, especially the divalent Mg and Ca which themselves form slightly soluble compounds with silicic acid and which are powerful coagulants of negative colloids.

**May, Walter J.**

Irish aluminous iron ores and aluminium production: Colliery Guardian v. 69, p. 25, London, 1895.

The question of producing both metallic iron and aluminum from the aluminous iron ores in North Ireland is discussed.

**Maynard, T. Poole.**

1. Bauxite in the United States: Mineral Industry, 1918, v. 27, p. 24–27, 1919.

Statistics include: domestic production by States, imports, and consumption, 1909–19; and world production, by countries, 1913–17. The geologic and geographic occurrence of bauxite in the United States is discussed briefly by States. There is also a section on foreign deposits, pages 27–29.

2. Bauxite: Mineral Industry, 1919, v. 28, p. 17–22, 1920.

Statistics include: domestic production by States, imports, and consumption, 1909–18; and world production, 1915–19. Short sections are devoted to the bauxite industry in the United States, the uses of bauxite, and foreign deposits.

3. Bauxite: Mineral Industry, 1920, v. 29, p. 19–22, 1921.

Statistics include: domestic production by States, imports, and consumption, 1909–20; and world production by countries, 1916–20. The producing areas and operating companies are described by States and by counties.

4. Bauxite: Mineral Industry, 1921, v. 30, p. 27–31, 1922.

Statistics are given of domestic production by States, imports, and consumption, 1913–21, and of world production by countries, 1916–21. The Everhart process for concentrating low-grade bauxite by washing in the presence of peptizers is discussed.

5. Bauxite and aluminum: Chem. Age, p. 86–88, 1922.

Production of bauxite in the United States is given for several years between 1909 and 1921. The mining companies in operation in 1922 are listed, and the location of commercial deposits in the United States is stated briefly. The Everhart process for the beneficiation of bauxite is shown to reduce the silica content from about 25 percent to 12 percent. The processes used in the manufacture of aluminum are briefly described.

**Mead, W. J.**

Occurrence and origin of the bauxite deposits of Arkansas: Econ. Geol. v. 10, no. 1, p. 28–54, 7 figs., 6 pls., 1915.

Previous work is reviewed and the general geology of the region is discussed. Two classes of bauxite are recognized: (a) bauxite in place; and (b) transported and detrital bauxite. The first overlies kaolinized syenite; the second is interstratified with Tertiary sediments. Bauxite deposits vary in size but average about 11.5 feet in thickness. The ore is white, buff, yellow, red, brown, and gray in color, and has a pisolitic or granitic texture. Chemical and mineralogic analyses show the principal constituents to be aluminum trihydrate, kaolin, hydrous iron oxides, siderite, and titanite. Evidence is given to show that the deposits were derived from the weathering of the syenite with kaolin as an intermediate product. Open texture of kaolin is thought essential to the change to bauxite. The author considers that pisolites were developed in place from granitic bauxite by the action of percolating surface water, as in the formation of concretions.

**Megaw, Helen D.**

The crystal structure of hydrargillite, $Al(OH)_3$: Zeitschr. Kristallographie, Band 87, p. 185–204, 1934 [English].

A study of the hydrargillite (gibbsite) molecule showed it to be monoclinic and pseudohexagonal, and to have a layer lattice structure. The mean interionic distances were calculated. The cell dimensions, the general positions of the space-group, and the coordinates of the atom are given.

**Mehta, S. M.**

Bauxite: Gwalior Mineralog. Ser. no. 18, 23 p., 1 map, 1925.

**Mellen, Frederic Francis**

1. The Little Bear residuum: Miss. State Geol. Survey Bull. 34, 36 p., 11 figs., 1 pl., 1937.

The concentration and origin of phosphate, chert, tripoli, iron ore, clays, and bauxite in the Little Bear residuum at the Paleozoic-Mesozoic unconformity would indicate a long period of subaerial weathering conditions. The bauxite and clay deposits discussed are those of Tishomingo County, Miss., and Colbert County, Ala.

2. (and McCutcheon, Thomas Edwin). Winston County mineral resources: Miss. State Geol. Survey Bull. 38, 169 p., 1 pl. (geol. map), 27 figs., 1939.

*Aluminum, page 51.*—All bauxite in Winston County, Miss., occurs in the Betheden formation, residual from the Porters Creek clay and was formed during the Midway-Wilcox interval. The highest grade bauxite found caps a small hill in Sec. 27, T. 14 N., R. 14 E., but the tonnage is very small and no other outcrops occur nearby. The bauxite deposits described in this bulletin are only those discovered in this county after the publication of Bull. 19, by P. F. Morse, in 1923.

**Mennell, F. P.**

Notes on Rhodesian laterite: Geol. Mag., decade 5, v. 6, no. 3, p. 350–352, 1 fig., 1909.

The author suggests that distinct alternating wet and dry seasons, is the important factor in the formation of laterite. In Rhodesia it is found overlying gravel, sandstone, limestone, granite, basalt, picrite, various schists, and serpentine; and is said to be derived from all these rock types except the gravel and sandstone. The chemical composition of a "normal laterite" is about 15–32 percent $Fe_2O_3$, 1–0.2 percent $Al_2O_3$, 4–6 percent water, and 75–61 percent $SiO_2$.

**Merwin, H. E.**

(and Posnjak, E.). Clays and other minerals from the deep sea, hot springs, and weathered rocks: Am. Jour. Sci., v. 35–A, p. 179–184, 1938.

A sample of a red residual soil was collected by T. W. Vaughan from the limestone of the Anguilla formation on the Island of Anguilla, in the West Indies. The soil consists of pellets, some spherulitic, which have an index of refraction of 1.62–1.64 and a high birefringence. X-ray examination showed abundant boehmite, little hematite, quartz, and kaolinite.

**Metcalfe, June**

Aluminum from mine to sky: 128 p., 39 photos., 1 fig., New York, McGraw-Hill Book Co., Inc., 1947.

This is a nontechnical, but full, account of the development of a commercial

process for the reduction of alumina to metallic aluminum. It also tells of the present day methods of prospecting, mining, and processing the bauxite into aluminum.

**Meulen, J. ter.**

Enkele Waarnemingen bij de Kaolien van Paranam [Surinam]: Geologie en Mijnbouw, Jaarg. 10, n. s., no. 6, p. 121–129, 10 figs., 1948 [Dutch, English summary].

Of a number of kaolin samples from Surinam, one from Paranam seemed to give some information on probable origin. The sample consisted of hydrargillite (gibbsite) in irregular grains, some of which had kaolinite cores; kaolinite crystals; glauconite; remains of marine shells; and Foraminifera. The quartz showed corrosion by solution; hydrargillite had partly replaced the kaolinite. The deposit is a leached marine sediment derived from the feldspar constituents of metamorphic rocks. The bauxite overlying the kaolin probably originated from the latter.

**Meunier, Stanislas.**

1. Sur l'existence de la bauxite à la Guyane française: Acad. sci. Paris Comptes rendus, tome 74, p. 633–634, 1872 [French].

Analysis of a sample of material on hand, labeled "peroxyde de fer globulaire" showed it to be bauxite, thus establishing the existence of bauxite in French Guiana.

2. Sur l'origine et le mode de formation de la bauxite et du fer en grains: Acad. sci. Paris Comptes rendus, tome 96, p. 1737–1740, 1883 [French].

Calcium carbonate is well known in the laboratory to be a precipitant of aluminum and iron hydroxides; this relation has been extended to derive an explanation of bauxite deposits. It is postulated that waters ascending from depth and containing iron and aluminum hydroxides in solution, would precipitate these hydroxides when and if they come into contact with calcium carbonate of limestone formations.

3. Résponse à des observations de M. Augé et de M. A. de Grosouvre sur l'histoire de la bauxite et des minerais sidèrolithiques: Soc. géol. France Bull., 3e série, tome 17, p. 64–67, 1889 [French].

This paper is a reply to one by Augé appearing in the same periodical (tome 16, p. 345–350, 1888) and to one by Grossouvre (tome 16, p. 287–289) on the formation of bauxite in limestone as distinct from that formed directly from underlying igneous rocks.

**Middelberg, E.**

Geologische en technische aanteekeningen over de goudindustrie in Suriname: 132 p., 3 pls. (incl. geol. map and sections), 3 figs., 18 photographic pls., Amsterdam, J. H. de Bussy, 1908 [Dutch].

**Middlemiss, C. S.**

Bauxite-deposits of Jammu Province [India]: Jammu and Kashmir Govts., Min. Survey Rept., p. i–iv and 1–60, 17 pls. (incl. geol. maps and section), 1928.

**Midwest Research Institute.**

Mineral resources of Nebraska, Iowa, Kansas, Missouri, Oklahoma, Arkansas: Prepared by the Midwest Research Inst., Kans. City, Mo., in Cooperation

with the [U. S.] Geological Survey and research bureaus of the various States, 1946. Scale 1:1,250,000.

The bauxite deposits of Arkansas are shown on the map by symbol. A brief text accompanies the map.

**Milic, L. Tonko.**

Dalmatian bauxite: Eng. Min. Jour.-Press, v. 115, p. 349, 1923.

This is a brief note on production of Dalmatian bauxite in 1921 and includes chemical analysis of the ore. Information on bauxite cements is requested.

**Miller, R. B.**

(and Herring, C. T.) Bauxite and aluminum: U. S. Bur. Mines Minerals Yearbook 1936, p. 395–412, 2 figs., 1936.

Statistics on domestic and world production and consumption include the current and previous years. The production and uses of domestic and imported bauxite are discussed. A section on foreign bauxite and aluminum industries shows production figures, operating companies, types and locations of installations, areas mined, some chemical analyses or information on grade of ore. The names of the producers and consumers of bauxite in the United States are listed. Production of bauxite and aluminum are shown on graphs. Ninety-four percent of the domestic production came from Arkansas; the remainder came from Alabama and Georgia and was used exclusively in the chemical industry.

**Miller, Willet G.**

Lateritic ore deposits, with comments on the nature of laterites in general: Ontario Bur. Mines Rept., v. 26, pt. 1, 19 p., 4 figs., 1917.

The paper consists of a brief discussion of various types of laterites, as the nickel and cobalt lateritic ores of New Caledonia, lateritic iron of Cuba, manganese ores of India, aluminous laterites of India and the United States, and lateritic gold deposits of British Guiana.

**Miranda, Luiz Ignacio.** *See* Feigl, Fritz

**Miropol'skiy, L. M. (Miropolsky, Miropolskii).**

Boksity u d. Volkovoy Kamenskogo rayona na Urale [Bauxites near the village Volkova in the Kamenskiy district of the Urals]: Kazan'. univ. Uchenyye zapiski geologiya, tom 94, kniga 1, geol. vypusk 3, p. 216–235, 1934; Kazan'. gosudar. univ., Obshch. yestestvoispitateley Trudy, tom 52, vyp. 5, p. 216–235, 1934 [Russian, English summary].

The bauxite deposits near Volkova in the Kamensk region of the Ural Mountains, U.S.S.R., are shown to be the result of lateritic weathering and, from top to bottom, consist of: (1) a friable white to red, stony, pisolitic bauxite, 0.2–3.0 meters thick; (2) a hard, brick red stony pisolitic bauxite, 3–6.8 meters thick; and (3) a "claeue," brick red stony pisolitic bauxite, 6.5–7 meters thick.

**Misch, Peter.**

On the facies of the Carboniferous of the Kunming region, eastern Yunnan, with special reference to the bauxite deposits: Geol. Soc. China Bull., v. 26, nos. 1–4, p. 1–64, 20 figs., 2 pls. (geol. sketch maps), 1946 [English].

This paper presents the results of a detailed study of the Carboniferous rocks in the Kunming region, China, in which "comparatively weak subsidence interrupted by a few major and numerous small upward oscillations, resulted in the deposition of a comparatively thin succession of shallow-water marine deposits

associated with terrestrial sediments formed in coastal flats". The climate is considered to have been warm and humid, because of the persistent occurrence of corals and large foraminifera in the marine sections, and of coal and bauxite deposits in the terrestrial facies. Bauxite lenses and layers have been discovered to occur throughout the Carboniferous, but especially in the upper parts. There is considerable horizontal and vertical variation in the silica content of fresh bauxites with a graduation from bauxite to bauxitic and argillaceous shale. Preliminary investigations suggest that a much later weathering cycle related to a Tertiary land surface has produced the high-grade ore by leaching the parts of beds exposed at that time. Ore containing less than 10 percent silica seems restricted in distribution, but reserves of fresh, lower grade material is practically unlimited. It is considered that in marine Carboniferous formations $C_1$ and $C_3$ some laterization must have taken place before the material was carried into the basins, but that in terrestrial formations $C_2$ and $C_4$ laterization could have continued after deposition.

**Misra, R. C.** *See* Chhibber, H. L.

**Mitra, Anil Krishna.** *See* Neogi, Panchanan.

**Mohr, Edward Carl Julius.**

1. Tropical soil forming processes and the development of tropical soils, with special reference to Java and Sumatra (De gond van Java en Sumatra, 2d edition, 1930), translated from the Dutch by Robert L. Pendleton: 206 p., 4 figs., Peiping, National Geological Survey of China and Section of Geology, National Academy of Peiping, 1933 [English, 6 p. Chinese summ.].

The factors which determine the rate of chemical weathering and the resultant soil are: (1) the quantity of water, (2) the composition of the water, and (3) the temperature. The effect of variation in these basic factors is shown in the soil types produced. The quantity of water is considered from the point of view of ratio of rainfall to evaporation, and the relation of rainfall to soil permeability and capillarity. The importance of temperature is considered in the study of difference in optimum temperature for macro- and microflora; the author concludes, "in the moist, warm tropics, with the average temperature of 25° C or higher, no humus can exist with full aeration; let alone accumulation of humus." However, in places where the ground-water table is at or above the surface, the microfauna is much less effective and the breakdown of humus is relatively less, so that even with an average temperature of 25° C, humus will accumulate.

The composition of the water is important in that silicic acid and kaolin are soluble in pure water but not in that containing salts, carbonic acid, or organic matter, whereas iron oxide and alumina are insoluble in pure or salt water but go into solution in water that is acidic or contains humus. Thus leaching with pure water causes the removal of free silicic acid and, eventually, even kaolin, leaving iron oxide and alumina as a residual accumulation. Leaching with humus-bearing water results in products rich in silica but poor in iron and alumina.

"Lixivium" is suggested as a substitute for the terms "laterite" or "laterite soils", for it signifies "leached out" and is applied to residual accumulations consisting largely of iron oxides and alumina.

The second part of the book is a detailed description of the soils of Java and Sumatra.

2. The soils of equatorial regions, with special reference to the Netherlands East Indies (De bodem der tropen in het algemeen, en die van Neder-

landsch-Indie" in het bijzonder), translated from the Dutch by Robert L. Pendleton: 766 p., 257 figs., Ann Arbor, Mich., Edwards Brothers, Inc., 1944.

*Pt. I, General considerations, 192 p.*—The minerals constituting igneous rocks and their weatherability are discussed: the calcium-sodium feldspars weather faster than the potassium; quartz is relatively resistant to erosion; the dark minerals weather in the following order (the last, most easily); mica, hornblende, augite, hypersthene, and olivine. Differences in the pH of the water cause differences in the resultant weathered material. Quartz does not dissolve in pure or acid water but does dissolve in water at pH 7.5 or greater; if such solutions become acid, opal will precipitate out. Alkaline feldspars in both pure and acid waters are leached of their bases, together with some silicic acid, leaving a residue consisting largely of kaolin with some silica. Calcium feldspar, when leached with pure or slightly acid water, losès the bases and then the silica into solution leaving an aluminum hydroxide residue. If the water contains humus and has a pH value of 3–5, the alumina will go into solution and the residue will consist of kaolinite and silica. The amphiboles and pyroxenes hydrolize in water with a pH of 7 to 5.5 which dissolves out the bases and silica and leaves the alumina and iron as a residue; if the water is more acid than 5.5, silica only remains. Chemical analyses of a great many igneous and some metamorphic rocks from the Dutch East Indies [Indonesia] are included. Data on rainfall and temperature and the effects of these and insolation on plant growth and accumulation of humus in the soil are discussed. Types of soil profiles occurring in tropical regions and the factors affecting differences in erodability of soils are carefully described.

*Pt. II, the soils of the Netherlands Indies, p. 193–766.*—"Soil-forming rocks, climate, weathering processes and the resulting soil types, evaluation and utilization of the soils" are discussed for Bali, Lombok, Soembawa, Flores, Soemba, Timor, Netherlands New Guinea, some of the Molukkas, Halmahera, Celebes, Borneo, Bangka, Billiton, Sumatra, Java, and Madera.

**Moldavantsev, Ye. P.**

Boksity Severnogo Urala i problemy ikh izucheniya (Bauxites of the Northern Urals and the problems of their investigation): U. S. S. R., Tsentral'niye nauch.-issledov. geol.-razved. inst. Trudy, vyp. 24, 56 p., 6 figs., geol. sketch map, Moscow-Leningrad, 1934 [Russian, English summary].

In 1931–32, bauxite deposits of Paleozoic age were discovered in the northern Ural Mountains in four localities of the Nadezhdinsky and Ivdel districts: (1) Krasnaya Shapochka, (2) Bogoslovsk, (3) Nikito-Ivdel village, and (4) the Talitza River. The first has been most studied, and reserves are estimated to be 1¾ million tons. Deposits in all four localities occur in a comparatively narrow north-south zone extending some 200 km. along the eastern slope of the northern Urals. The bauxite occurs as lenses and beds in Lower and Middle Devonian limestones. These deposits may be as much as 9 meters thick but average 3–4 meters. Mineralogically the bauxite consists largely of diaspore or the monohydrate gel. In the Krasnaya Shapochka deposit, the gel form is the predominant one, and for this reason 90 percent of the alumina can be extracted by the Bayer process. The deposits at Ivdel have been highly metamorphosed and altered and consist largely of diaspore. Bauxite in the area is considered to have been formed by the lateritic weathering of tuffs and other material during a continental period in the Paleozoic and was subsequently transported and deposited in the existing lagoons.

**Morse, Paul Franklin.**

(and Hand, William Flowers.) The bauxite deposits of Mississippi: Miss. State Geol. Survey Bull. 19, 208 p., 14 maps, 1923.

The bauxite deposits of Mississippi are irregularly scattered through a belt of high hills and ridges which extend from near the Tennessee line south and southeastward to the northwest part of Kemper County. The largest of these deposits occur in Pontotoc, Tippah, and Benton Counties. The bauxite lies near the base of the Ackerman formation (base of the Wilcox group) which overlies the Porters Creek clay. The bauxite is interstratified with bauxitic clay, kaolin, and impure clay.

A brief introductory description of foreign and domestic deposits is given, with production and consumption data. The geology and bauxite deposits of Mississippi are described in detail by counties. There is a section on technology, including mining, uses, and grades of ore, and one on methods of chemical analyses.

**Morse, W. C.**

Mississippi minerals: Miss. Geol. Survey Bull. 59, 13 p., 1944.

The mineral resources of Mississippi are discussed briefly. This paper is partly a check list, and the resources that have been studied in detail and the results published are listed by counties and by Mississippi Geological Survey bulletin number.

**Moss, C. E.** *See* Cole, Grenville A. J.

**Motăs, C. L. L.** *See* Puscarin, V.

**Mote, Richard H.**

(and Kurtz, Horace F.). Bauxite: U. S. Bur. Mines Minerals Yearbook, 1948, p. 176–187, 1950.

Domestic mine production increased nearly 21 percent over that in 1947; of the total, 96 percent came from Arkansas. Alabama and Georgia were the only other producing States. Imports increased 37 percent over the previous year. The aluminum industry used 84 percent of the domestic and imported ore; the chemical, abrasive, and refractory industries used most of the remainder. Statistics on domestic and world production and consumption include the current and previous years. Bauxite mining in foreign countries is discussed and data on size of deposits, new developments, and names of mining companies are included.

**Müller, Martha.** *See* Spangenberg, Kurt.

**Munyan, Arthur C.**

Supplement to sedimentary kaolins of Georgia: Ga. Geol. Survey Bull. 44–A, 42 p., 2 pls., 1938.

*Bauxite deposits of the Coastal Plain, pages 37–39.*—Changes in ownership or status of bauxite deposits and mines since the publication of Bulletin 44 are given briefly.

**Muraoka, Makoto.**

Aluminous shales in Manchuria and North China: Jour. Geography, v. 59, no. 1–2 (675–676), p. 22–29, 8 figs., Tokyo, 1950 [Japanese, English summary].

The aluminous shale occurs as nine layers in beds of Permian and Carboniferous age and unconformably overlies Ordovician limestones. The high-alumina con-

tent is due to diaspore, which is present as minute grains in kaolinite. The mineralogic composition is kaolinite, diaspore, nontronite, rutile, sporogelite, halloysite, chlor-opal, and dolerite. Approximate tonnages of proved and probable ore and their alumina content are tabulated by localities. The names of the localities are: Manchuria—Yen-tai, Han-po-ling, Pen-chi-hu, Niu-shin-tai, Tien-shih-fu-ko, Fu-chou, Ta-yao-ko, Hung-lo-hsien in Manchuria; and Chang-chen, Chi-tung, and Shan-tung in North China.

**Murton, Charles J.**

(and Saville, Shaw). A deposit found at Delaval Colliery, Benwell, Northumberland: Federated Inst. Min. Engineers Trans., v. 10, p. 67–71, 1895; North England Inst. Min. Engineers Trans., v. 14, p. 67—71, 1895.

A white, claylike material was found to underlie the main coal seam at Delaval colliery. Chemical analysis showed 37.93 percent alumina, 12.12 percent silica, 1.90 percent lime, 5.30 percent sulphuric anhydride, and 42.44 percent water. It is suggested that aluminite and collyrite are the main constituents of the mixture. The formulas for these two substances are $Al_2(SO_4)_3 \cdot 2Al_2O_3 \cdot 9H_2O$ (aluminite) and $2Al_2O_3 \cdot SiO_2 \cdot 9H_2O$ (collyrite).

**Musset, René.**

La production de la bauxite aux États-Unis: Soc. géol. minéralog. Bretagne Bull., tome 2, fasc. 2, p. 264–273, 1921 [French].

The bauxite deposits of the United States are briefly described and production figures for the years 1914 through 1919 are included.

**Nahmias, M. E.**

Bauxites et mullites étudiées au moyen des rayons X: Zeitschr. Kristallographie, Band. 85, p. 355–369, 11 figs., 1933 [French, German summary].

The structure of mullite and of the end product of mixtures of bauxite and kaolin were studied. X-ray patterns were used to note differences in the structure of samples which were calcined at a series of temperatures. The change in crystal structure of the bauxite minerals is of interest.

**Nalivkin, D. V.**

On the bauxites of the Urals: Akad. nauk SSSR Izv., Ser. geol., no. 4, p. 3–5, Moscow 1942 [Russian, English summary].

Two types of bauxite are differentiated—those occurring in marine sediments, and those in lacustrine deposits. The marine type has been found at various horizons in strata of Silurian and Devonian age. The fresh-water, or cemented type, has been found at three horizons: in strata of Carboniferous, Jurassic, and Lower Cretaceous ages.

**Náray-Szabó, István.**

(and Neugebauer, —). Magyar bauxitok röntgenvizsgalata: Technika, 25 évfolyam, Budapest, 1944 [Hungarian].

X-ray analyses of Hungarian bauxites are discussed.

**Nelson, Reuben A.** *See* Hendricks, Sterling B.

**Nelson, Wilbur A.**

1. Volcanic ash bed in the Ordovician of Tennessee, Kentucky, and Alabama: Geol. Soc. America Bull., v. 33, no. 3, p. 605–616, 1922; abs., discussion, v. 33, no. 1, p. 152, 1922.

At the end of this paper, which is primarily a discussion of the age and extent of the ash bed, a theory for the formation of bauxite from bentonite is briefly presented. Bentonite when boiled in acid forms aluminum sulphate, and the silica goes into solution. This fact is used as the basis of a theory that bentonite deposits in contact with pyrite-bearing rocks might likewise be attacked by sulphuric acid solutions. The aluminum sulphate precipitated in this process could possibly be reduced later, forming bauxite.

2. Appalachian bauxite deposits: Geol. Soc. America Bull., v. 34, p. 525–539, 4 figs., 1923.

Bauxite deposits on the eastern side of Missionary Ridge in southern Tennessee lie at an elevation of approximately 850 feet, the height of the now dissected White Oak Mountain–Highland Rim peneplain which was uplifted in late Pliocene or early Pleistocene time. The bauxite deposits are considered to have been formed much later than the Eocene, possibly early Pleistocene. Bauxite is concluded to have been formed by the deposition on the peneplain surface of alumina leached from bentonite beds below and brought up along the fault plane by ascending waters.

3. Observations on different periods of igneous activity at Bauxite, Arkansas [abs.]: Geol. Soc. America Bull., v. 36, no. 1, p. 167, 1925; Pan-Am. Geologist, v. 43, no. 2, p. 158, 1925.

The abstract is a statement that the report deals with the possible age of the syenite mass at Bauxite, Ark., the character of the deposits, and the "three different periods when bauxite was formed and igneous activity took place".

**Nemova, Z. N.**

Mikroskopicheskoye issledovaniye boksitov Severnogo Urala (Microscopical investigation of bauxites of Northern Urals): Akad. nauk SSSR, Petro. inst. Trudy, vyp. 6, p. 485–489, 2 figs., Leningrad, 1934 [Russian, English summary].

Microscopic and X-ray studies of samples from the Bogoslovsky region in the Northern Ural Mountains, showed the presence of two types of bauxite—the boehmitic and diasporic.

**Neogi, Panchanan.**

(and Mitra, Anil Krishna). A new scaly variety of aluminum hydroxide: Chem. Soc. London Jour. pt. 1, p. 1222–1223, 1927.

In reducing various nitrates by means of an aluminum-mercury couple, glistening scaly crystals were obtained, which were found to have a composition of $Al_2O_3.4H_2O$. "Under the microscope they showed reflections from innumerable planes but no doubly refracting crystals and no resemblance to gibbsite; in view of the flaky appearance, however, it is probable that the substance consists of isometric crystals." A short review of the literature cites references to aluminum hydrates, prepared in the laboratory, which have 1, 2, 3, and 5 molecules of water.

**Neugebauer, —.** *See* Náray-Szabó, István.

**Neumayr, M.**

Zur Bildung der Terra rossa: Austria, K.-k. geol. Reichsanst. Verh., Jahrg. 1875, no. 3, p. 50–51, Vienna, 1875 [German].

The origin of terra rossa as a sediment deposited in a marine environment, and the relationship to *Globigerina* in the underlying strata are discussed.

**Ney, P. B.** *See* Raggatt, H. G.

**Nicholas, W. L. J.**

Bauxite mining in France: Mine and Quarry Eng., v. 3, no. 5, p. 175–183, 13 figs., London, 1938.

Most of the mines in operation in France are centered in the Brignoles district in the Department of Var, and in the Villeveyrac and Bedarieux districts of Hérault. Open-pit and underground mining methods are described, and numerous illustrations included. The location of all mining districts is shown on a small-scale map. A chart shows chemical composition, commercial uses, and approximate annual production of each of the 10 commercial grades of French bauxite. The mining laws applicable to bauxite are given; these are not based on the Napoleonic code because aluminum ore was unknown at that time. The cost of mining is discussed in detail, including all items from wages to explosives. Mine maps are figured.

**Nichols, Edward.**

An aluminum-ore: Am. Inst. Min. Eng. Trans., v. 16, p. 905–906, 1888.

This paper announces the first discovery of "beauxite" in the United States. The sample, collected from an iron-mining area in Floyd County, Ga., was submitted for analysis as possibly a peculiar variety of iron ore. Chemical analysis showed it to have a composition similar to French bauxites. The deposit consists of oolitic, light to dark red masses in clay in a lower Silurian formation.

**Nicolai, E. R.** *See* Ralston, O. C.

**Novarese, Vittorio.**

Der Bauxit in Italien: Zeitschr. prakt. Geologie, 11 Jahrg., Heft 8, p. 299–301, 1903 [German].

The bauxite deposits of the central Apennines, Italy, are briefly described; chemical analyses show 47–59 percent $Al_2O_3$, 36–19 percent $Fe_2O_3$, approximately 2–3 percent $SiO_2$, 11–12 percent $H_2O$, and minor amounts of $TiO_2$, CaO, MgO, and $P_2O_5$.

**Ohly, J.**

The occurrence of bauxite in Colorado and Wyoming, and its utilization: Min. Reporter, v. 44, p. 190–191, 1901.

Bauxite, reported to occur in large quantities in Colorado and Wyoming, is discussed from the point of view of freight costs, etc. A brief résumé of processes for the manufacture of metallic aluminum and alum is included.

**Olaechea, T.**

La Bauxita y su empleo: Soc. Nác. Minería Bol., ser. 3, v. 9, p. 46–48, Santiago, Chile, 1897.

A general discussion of bauxite, its industrial uses, and the Bayer process.

**Ollar, A.** *See* Malamphy, Mark C.

**Orcel, Jean.**

L'emploi d'analyse thermique différentielle dans la détermination des constituents des Argiles, des latérites et des bauxites: Cong. internat. mines 7$^{e}$ Sess., Sec. géologie appl., tome 1, p. 359–373, 5 figs., 1935 [French].

This important paper traces the development of thermal analysis methods back to the work of Chatelier in 1887. Characteristic peaks on the curves of various clay minerals and other fine-grained hydrous material are pointed out. The limitations and the value of the method are indicated. The curves figured are those of the clay minerals—kaolinite, nontronite, montmorillonite, beidellite, and collyrite—as well as pyrophyllite, hydrargillite, diaspore, limonite, goethite, and other hydrous minerals.

**Oregon Department of Geology and Mineral Industries.**

State of Oregon, Map showing mineral deposits. Scale 1:1,000,000, 1946.

The ferruginous bauxite deposits in the western part of the State are shown on the map by symbol.

**Orlov, Alexandr.**

1. Bauxity (jedich složení, vznik a výskyt): Věda-přirodní, rǒcnik 18, čislo 2, p. 47–52, 2 figs., Prague, 1937 [Czechoslovakian].
2. První výskyt bauxitu v Československu: Česká akad. věd. umění Rozpravy, Třída II, ročník 47, číslo 13, 22 p., 1 pl., 1937 [Czechoslovakian]; summary, Note sur le gisement de bauxite en Tchécoslovaquie: Acad. Tchèque sci., Bull. internat., Travaux présentés, 38e Année, p. 58–62, 1 pl., Prague, 1937 [French].

In 1936, bauxite was discovered in Czechoslovakia near the village of Mojtín between Žilina and Trenčín. The bauxite occurs at the base of Eocene conglomerates, in irregular and scattered pockets in Triassic limestones and dolomites that are brecciated and recemented by bauxite and secondary calcite. The bauxite varies greatly in color, from brown-maroon to white. The white may have white and yellow banding. Typical pisolitic bauxite is rare and is always red. In chemical composition, the pisolites differ from the matrix only in having a higher iron content. Some red bauxite contains spheres (0.1–8 mm in diameter) of white material composed of kaolinite and a monohydrate of aluminum. The red bauxites also contain small nests (0.01–1.0 mm in diameter) of well-crystallized kaolin. This bauxite contains little clastic material but some zircon and tourmaline.

Three types have been differentiated: (1) brown-maroon bauxite with ferruginous pisolites; (2) white bauxite; and (3) yellow and white bauxite. From dehydration curves and solubility in acid, it was found that type 1 contains kaolinite, allophane, and both mono- and trihydrates of aluminum. Types 2 and 3, however, probably contain only the monohydrate, boehmite, as well as halloysite. Iron in all types probably occurs as goethite. The age of the deposits is considered to be Late Cretaceous.

3. Bauxitvorkommen bei Reichenau an der Knezna in Boehmen: Neues Jahrbuch Beil. Band 74, Abt. A, Heft 2, p. 251–278, 3 pls., 1938 [German].

Petrographic and chemical analyses of bauxite deposits near Rychnov on the Knezna River, in Bohemia, Czechoslovakia, indicate that the important mineral components are: diaspore, 49.9 percent; chlorite, 21.5 percent; hydrous hematite, 18.6 percent; and kaolinite, 5.6 percent. The composition and texture of the material is variable but is generally red-brown and pisolitic. Under the microscope most of it is amorphous. The pisolites are 3 to 5 millimeters in diameter. Chlorite occurs chiefly in the form of earthy grains.

The deposits overlie an amphibolite schist and underlie sedimentary rocks of Late Cretaceous age, and may represent part of an alluvium developed on the crystalline rocks. It is suggested that these deposits were derived in part directly from the amphibolite by a lateritic weathering in low swampy areas and in part from

the weathering of materials which by chemical and mechanical means were transported into these swamps.

4. Výskyty bauxitů v. ČSR: Věda-přirodní, měsičník pro šíření a pěstování vědomí Přirodních, ročnik 19, čislo 5, p. 137–140, 1 fig., Prague, 1938 [Czechoslovakian].

Bauxite deposits of Czechoslovakia are described.

5. Die "primäre" und die "secondäre" facies des Bauxit in der Lagerstätte von Mojtín: Czechoslovakia, Státní geol. ustav Věstník, ročnik 14, čislo 1–2, p. 18–25, 2 pls., Prague, 1938 [1939] [Czechoslovakian, German summary].

Two facies are distinguished in the Mojtín bauxite deposit, Czechoslovakia: (1) bauxite formed in place in Triassic limestone either as a chemical sediment or the product of the laterization of a clayey material which filled karst cavities; and (2) transported beds, composed mainly of boehmite, occurring in pockets in Triassic dolomite. The bauxite deposit is overlain by Eocene conglomerates.

**Owen, David Dale.**

Second report of a geologic reconnaissance of the middle and southern counties of Arkansas made during the years 1859 and 1860: 433 p., 5 pls., 5 figs., Philadelphia, C. Sherman and Son, 1860.

Bauxite in Pulaski County is described on page 70, but it is not recognized as such and is called a "* * * ferruginous amygdaloid" which has "* * * the appearance of pea-stone, the cavities being mostly empty."

**Owen, H. B.** *See* Raggatt, H. G.

**Packard, R. L.**

1. Aluminum: U. S. Geol. Survey Min. Res. U. S., 1882, p. 445.

Statistics on the production of aluminum in pounds, the value, and imports constitute most of the report. The retail price of aluminum is reported at $1.25 per troy ounce.

2. Aluminum: U. S. Geol. Survey Min. Res. U. S., 1883 and 1884, p. 658–660, 1885.

Aluminum during this period was used in minor amounts for the manufacture of alloys and for the lighter parts of delicate instruments. A process for the extraction of aluminum from bauxite was patented by Col. William Frishmuth.

3. Aluminum: U. S. Geol. Survey Min. Res. U. S., 1885, p. 390–392, 1886.

Production figures on the aluminum manufactured in the United States are given, together with statistics showing imports of bauxite and aluminum.

4. Aluminum: U. S. Geol. Survey Min. Res. U. S., 1886, p. 220–221, 1887.

The production and value of the aluminum manufactured in the United States are given. Statistics on the production of aluminum alloys and imports are also included.

5. Aluminum: U. S. Geol. Survey Min. Res. U. S., 1887, p. 138–141, 1888.

The processes used in the manufacture of aluminum, aluminum bronze, and ferro-aluminum are briefly explained. The physical properties of the alloys are pointed out.

6. Aluminum: U. S. Geol. Survey Min. Res. U. S., 1888, p. 160–164, 1890.

The process, invented by C. M. Hall, of reducing alumina to metallic aluminum by electrolysis, was put into operation by the Pittsburgh Reduction Company

during this year. Statistics include those of production and consumption of aluminum, imports, and domestic production of bauxite.

7. Aluminum: U. S. Geol. Survey Min. Res. U. S., 1889 and 1890, p. 110–118, 1892.

The industrial uses of aluminum are given, and reduction processes described briefly. Statistics on production and consumption for the period are also included.

8. Aluminum: U. S. Geol. Survey Min. Res. U. S., 1891, p. 147–163, 1893.

The literature describing the bauxite deposits of the world is reviewed. The metallurgical processes, uses, and new types of alloys are briefly discussed. Statistics on production and imports are included.

9. Aluminum: U. S. Geol. Survey 16th Ann. Rept., pt. 3, p. 539–542, 1 fig., 1895.

The results of physical tests on silicon and aluminum steels are given, and also the uses of aluminum, and production and imports for the current and previous years. The important bauxite districts of the world are mentioned.

**Paiva, Glycon de.**

(and Capper Alves de Souza, Henrique, and Fróes Abreu, S.). Ouro e Bauxita na Região do Gurupy (Pará-Maranhão): Brazil, Serviço Fomento Producção Min. Bol. 13, 172 p., 31 pls., Rio de Janeiro, 1937 [Portuguese].

Parts 1 and 2 include a historical sketch and the geography of the area; part 3 comprises data on gold deposits and production; part 4 is entitled "Note on the phosphate of Trauhira" and refers to bauxite and phosphate. The various phosphate rocks of the island are the result of phosphatization of laterite and bauxite. The iron of the laterite is predominant at the surface and forms a hard iron crust. Below, the aluminum and phosphorous contents increase; this material analyzes approximately 17 percent water, 31 percent alumina, 30 percent phosphate, 5 percent iron oxide, 6 percent calcium oxide, a trace of titania, and 7 percent silica.

**Pandurango Rao, N.**

Bauxite occurrences in the Bababudan Hills (India): Mysore Geol. Dept. Rec., v. 38, 1939, p. 116–126, 1 pl. (map), 1940.

The bauxite deposits of the Bababudan Hills are ferruginous. They occur in deposits less than 8 feet thick within limonitic material. Reserves for the area are estimated to be 201,300 tons for all grades of material. Reserves of bauxite of 55–60 percent alumina, and 10 percent iron oxide, amount to 6,300 tons. Mining and transportation costs, and uses of this bauxite are briefly discussed.

**Panov, A. D.**

Alyuminiyevyye gliny Priozernogo rayona Severnogo kraya [Bauxite clays of the lake district of the northern region]: Razvedka Nedr, no. 22, p. 17–19, Moscow, 1936.

Bauxitic clays of the lake district of north European U. S. S. R., especially in the Onega River district.—*V. 7, 1939.

**Papp, Ferenc.**

Bauxit a Zugligelböl—Bauxit aus dem Zugliget: Magyar földt. társulat Földt. közlöny, kötet 64, füzet 7–9, p. 266–267, 1 fig., 1934 [Hungarian, German title].

Bauxite deposit at Zugliget, Hungary occurs in sink holes in dolomite and is overlain by a thin bed of Eocene conglomerate.

**Parker, Edward W.**

Arkansas bauxite-deposits: Mines and Minerals, v. 20, p. 327–328, 1900.

Bauxite production in the United States began with the opening of deposits in the Coosa Valley in Georgia and Alabama. In Arkansas, deposits occur in Saline and Pulaski Counties, but by 1900 only a small area about 3 miles south of Bryant, Saline County, was producing. Development of other areas was awaiting improved transportation facilities. The Southern Bauxite Mining and Manufacturing Co., E. E. Metzenaur, and the Pittsburg Reduction Co. owned and developed property in the area.

**Parmelee, E. Bruce.** *See* Bryson, R. P.

**Passarge, S.**

Über Laterit und Roterden in Afrika und Indien: Internat. Geog. Cong., 6th Cong., London, Rept, p. 671–676, 1895. Abs., Neues Jahrbuch, Jahrg. 1897, Band 2, p. 471, 1897 [German].

The red laterites of the tropics characteristically contain concentrations of round iron oxide concretions. The yellow soils differ from these in mode of formation, for the concentration of the red iron oxide is related to the action of humic acids on the parent material.

**Patel, M. S.**

Occurrence of bauxite in the Thana district, Bombay [abs.]: Indian Sci. Cong., 22d, Calcutta, 1935, Proc., p. 217–218, 1935.

**Pauls, Otto.**

Die Aluminiumerze des Bihargebirges und ihre Entstehung: Zeitschr. prakt. Geologie, 21 Jahrg., p. 521–572, 1 pl., 8 figs., 1913 [German].

The bauxite deposits of the Bihar Mountains, Rumania, are described. Two types of bauxite are differentiated: the primary, resting on the eruptive rocks from which it was derived; and the secondary, which is oolitic and concretionary and overlies limestone.

**Pavlinov, V. N.**

Boksity Shakhristanskogo rayona (severnyy Tadzhikistan) [Bauxites of the Shakhristan region (northern Tadzhikistan)], *in* Tadzhiksko-Pamirskaya èkspeditsiya 1933–1935 [Tadzhik-Pamir Exped.], vyp. 39: 48 p., 23 figs. (incl. geol. sk. map), Moscow, Akad. Nauk SSSR, Trudy i materialy, 1936 [Russian].

Describes the bauxite deposits of the Shakhristan region, northern Tadzhikistan, Russia, including a discussion of the stratigraphy of the region and genesis of the deposits.—*V. 5, 1937.

**Pawlowski, Auguste (Pavlovski).**

Les bauxites françaises: Paris, 46 p., 2 pls., 1 fig., Charles Jules et A. Brunet, 1925 [French].

The bauxite deposits of France are described by districts; the largest deposits and the highest grade ore occur in the Department of Var. Reserves approximate 60 million tons for the country as a whole. For Var alone, 40–45 million tons was estimated to contain 60 percent alumina and less than 5 percent silica. National production is shown for selected years from 1873 to 1913. The age of the deposits throughout the country is considered to represent the Gault and

Aptian intervals although in most places the whole stratigraphic column is not present.

**Peile, William.**

Notes and analyses of iron ores and bauxite from the Crommelin Mines, County Antrim: Manchester Geol. Soc. Trans., v. 22, p. 522–525, 1894.

Pisolitic ore [iron ore], bauxite, and lignite all appear to occur in the same bed but not all in the same place. Analyses of pisolitic iron ore show 59.4 percent iron oxide, 2.8 percent alumina, 10.4 percent silica, 8.4 percent water, and 19 percent other constituents; chemical analyses of first quality bauxite show 53.8 percent alumina, 1.57 percent iron oxide, 8.67 percent silica, 29.27 percent combined water, and minor amounts of other constituents.

**Pekár, Desider.**

Bauxitok kimutatása fóldmagneses mérésekkel—Nachweis von Bauxiten mit der erdmagnetischen Messungen: Magyar tudományos akad., Mat. természett. Értesitő, Band 56, Teil 1, p. 219–230, 1 pl. 1937 [Hungarian, German summary].

A modified technique of measuring relative differences in value in the earth's magnetic field was used to study a bauxite deposit near Gant, Hungary. The iron content of the bauxite gave weak magnetic effects detectable by the instrument so that the probable limits of the ore body could be delimited.

**Peña y Lillo, Oscar.**

La bauxita: Soc. Nàc. Minería, Bol. Min., Año 46, v. 42, no. 371, p. 118–122, Santiago, Chile, 1930 [Spanish].

Small concretions from Juan Fernandos Island and from the mountains of the Province of Linares containing 63 percent alumina are mentioned. This general paper on bauxite includes a brief discussion of the most important bauxite mining districts in the world. Production figures, 1923–27, are given by countries, and a sketch of the trade conditions is included. There are no commercial bauxite deposits in Chile.

**Pendleton, Robert L.**

1. On the use of the term laterite: Am. Soil Survey Assoc., 16th Ann. Mtg. Bull. 17, p. 102–108, 1936.

Because of great diversity in the meaning of the term laterite, the author presents the concept outlined by Mohr in 1933 in "De Bodem der Tropen in het Algemeen in die van Nederlandsch-Indie in het Bijzonder." (See Mohr, E. C. J., 1.) Laterite is considered to be "the hardened illuvial horizon consisting of sesquioxides exposed by truncation of the profile thru erosion." It is, therefore, a soil or a part of a soil profile, with definite physical characteristics which can be recognized in the field. Chemical analyses and silica-sesquioxide ratios are not adequate criteria unless the whole soil profile and parent rock is analyzed.

2. Further notes on laterite: Pacific Sci. Cong., 6th, Proc., v. 4, p. 973–978, 1939.

It is suggested that the term laterite be restricted to that type of material originally described and named by Buchanan. The following points are discussed: (1) Laterite is developed in the illuvial horizon in the soil profile. (2) Although laterite occurs in many places in the tropics, it is not common. (3) The regional climate is not the most important factor in the development of laterite, although a humid tropical climate facilitates it. (4) Laterite has been used in the con-

struction of buildings for many centuries in India, Malaya, Cambodia, and Siam. (5) Laterite cannot be molded into bricks, but must be quarried. (6) The two principal textures of laterites are vesicular and pisolitic.

3. Laterite and its structural uses in Thailand and Cambodia: Geog. Rev., v. 31, p. 177–202, 63 figs. (photos., index map), 1941.

Laterite is considered to be that concretionary mass of iron and other sesquioxides formed as the illuvial horizon during the later stages of soil weathering. Typical laterite is sufficiently hard to quarry for building blocks. The position of the illuvial horizon is determined by the upper surface of ground water which must be close enough to the surface so that the iron compounds can oxidize; hence peneplanation is conducive to the formation of laterite. If the matrix in which the illuvial horizon forms is clayey, the resulting laterite will be cellular and slaggy; if the matrix is sandy, the laterite may be pisolitic in addition to containing much quartz. Laterite may contain a fairly high proportion of quartz and other inclusions. Because of its property of hardening on exposure, laterite has been used for building stone in Thailand and Cambodia for over a thousand years.

4. (and Sharasuvana, Sangar). Analyses and profile notes of some laterite soils and soils with iron concretions of Thailand: Soil Sci., v. 54, no. 1, p. 1–26, 8 figs., 1942.

Descriptions of profiles and chemical analyses of samples of laterite and related soils from many places in Thailand form the bulk of the paper. Suggestions made for the study of tropical soils include the use of the term lixiviation, as proposed by Mohr to indicate all leaching processes, as more useful than the commonly used podzolization or laterization.

5. (and Sharasuvana, Sangar). Analyses of some Siamese laterites: Soil Sci., v. 62, no. 6, p. 423–440, 6 figs., 1946.

The term laterite is used in Buchanan's original sense for an indurated, slaglike or pisolitic material which hardens somewhat on exposure. Such material forms at the top of a fluctuating water table. A laterite soil is defined as one in which a laterite horizon is found in the profile; a lateritic soil is one in which there is an incipient or immature laterite horizon. Numerous chemical analyses of laterite from old buildings as well as from outcrops are included. In most of these the iron content is much higher than the alumina. The silica is also higher than the alumina.

**Peng, C. J.**

Notes on the bauxite deposits of Kueichou with special reference to their variation in quality: Geol. Soc. China Bull., v. 24, nos. 1–2, p. 87–103, 2 figs., 1945 [English].

The bauxite deposits of Kueichou, China, overlie Lower Ordovician dolomite and are overlain by a Lower or Middle Carboniferous coal series into which it grades upward. The bauxite is light gray or yellow, fine grained, compact, and looks like lithographic limestone; the texture may also be sparsely pisolitic or may be vermicular. The minerals identified were diaspore, rarely boehmite and gibbsite, kaolinite, halloysite, zircon, rutile, sphene(?), quartz, pyrite, and limonite. The average chemical composition is 45 percent alumina, 35 percent silica, 1 percent iron oxide, 14.5 percent loss on ignition, and 2.5 percent titania. The variations in texture—vermicular, coarse massive, and fine-grained—indicate variations in chemical composition, the last named the only one high in grade.

**Perederiev, V. A.**

Genesis of bauxites of the northwestern Nikopol near-Dnieper area: Akad. nauk SSSR, Doklady, nov. ser., v. 55, no. 1, p. 45–48, 1947 [English].

The bauxite deposits of the northwestern Nikopol near-Dnieper area, Russia, lie in the "basin of the right-hand tributaries of the Dnieper" river, and generally consist of fragments, clods, or pebble concretions, and occur as small conglomerate-like or breccia-like lenses resting on an ancient weathered surface. They are generally overlain by strata of Oligocene age. Some of the deposits are sandy and some grade laterally into a low-grade iron ore. The bauxite is considered to be autochthonous and the end-product of lateritic weathering.

**Petersen, T.**

Über Bauxitbildung: Zeitschr. Kristallographie, Band 25, p. 620, 1896; abs., Neues Jahrbuch, 1894, Referate, p. 460.

**Petrenko, A.**

K otkrytiyu boksitov v Orskom rayone [On the discovery of bauxites in the Orsk region]; Problemy Sovetskoy geologii, ONTI tom 4, no. 9, p. 63–68, Moscow, 1933 [Russian].

**Petronio, Mario.**

L'alluminio metallo nell'avvenire—le bauxiti istriane: Rassegna min. metall. Italia, anno 35, v. 69, no. 4, p. 65–74, Rome 1929 [Italian].

The three important aluminum oxides postulated in bauxite deposits are the crystalline monohydrate, diaspore; the amorphous dihydrate, bauxite, which is the predominant material in pisolites; and the crystalline trihydrate, gibbsite. The bauxite deposits of the Istrian Peninsula, Italy, were formed during a period of emergence as a residual accumulation from the weathering of calcareous rocks of Cretaceous age. Preliminary estimates of reserves in the Istrian Peninsula amount to about 10 million tons. Chemical analyses of many samples are included. The deposits extend over much of the Peninsula, but are sparse in the interior and numerous in the eastern part.

**Petunnikov, G.**

Die Bauxitvorkommen von Montenegro: Montan. Rundschau, Jahrg. 27, no. 23, p. 1–7, 7 figs., 1935 [German].

The bauxite deposits of Montenegro, Yugoslavia, occur principally in a rectangular area southeast of Bar extending east-southeastward inland from the Adriatic coast and covering about 250 square kilometers. The bauxite deposits occur along the strike along five main northwest-southeast lines. Of those the second and third lines are the most important. The area is strongly folded; thus the beds are repeated. The bauxite lies on the eroded surface of the Rudistid limestone and is overlain by the Nummulitic limestone and other younger beds. Chemical analyses are included; a typical one shows approximately 59 percent alumina, 18 percent iron oxide, 5 percent silica, 3 percent titania, and 14 percent water.

**Phalen, W. C.**

1. The production of bauxite and aluminum: U. S. Geol. Survey Min. Res. U. S., 1907, pt. 1, p. 693–705, 1908.

Statistics are given of domestic and world production and consumption of bauxite and aluminum in 1907 and previous years. The mining of bauxite in Tennessee began in 1907, and the known deposits are described. New deposits

were also discovered in Georgia in Wilkinson County. A section on foreign deposits discusses those of India. The mining companies and the areas in which they operated are discussed by States.

2. Bauxite and aluminum: U. S. Geol. Survey Min. Res. U. S., 1908, pt. 1, p. 697–708, 1909.

Statistics are given of domestic and world production and consumption of bauxite and aluminum in 1908 and previous years. The new bauxite field in Wilkinson County, Ga. is described in some detail from reports by O. Veatch.

3. Bauxite and aluminum: U. S. Geol. Survey Min. Res. U. S., 1909, pt. 1, p. 561–572, 1911.

The bauxite deposits being mined in the United States are described briefly by States. Statistics are given of production and consumption of bauxite and aluminum in 1909 and previous years.

4. The production of bauxite and aluminum: U. S. Geol. Survey Min. Res. U. S., 1910, pt. 1, p. 711–723, 1911.

Statistics are given of domestic and world production and consumption of bauxite and aluminum in 1910 and previous years. Bauxite is predominantly used in the manufacture of metallic aluminum, but it is also used for chemicals, abrasives, and refractory brick. A section on foreign deposits includes a discussion of those in France and brief mention of those in Italy.

5. Bauxite and aluminum: U. S. Geol. Survey Min. Res. U. S., 1911, pt. 1, p. 923–939, 1912.

The mining methods used in Arkansas, Tennessee, and Georgia, the deposits, and characteristic types of ore are described. The alunite deposit at Marysvale, Utah, is considered as a probable source of aluminum. Production and consumption statistics are included.

6. Prospecting for bauxite—aluminum ore: Min. Sci. Press, v. 105, p. 305–307, 4 figs., 1912.

In Arkansas, bauxite rests directly on kaolinized syenite. It may be granitic, pisolitic, or claylike in texture. The Appalachian bauxite of Alabama and Georgia occurs in discontinuous, round or ellipsoidal deposits associated with faults. The Tennessee deposits are similar and are a northern continuation of this Appalachian field. The central Georgia bauxite in Wilkinson County occurs at the contact between sedimentary rocks of Cretaceous and Tertiary age. Properties, field tests, and uses are briefly given.

7. The production of bauxite and aluminum: U. S. Geol. Survey Min. Res. U. S., 1912, pt. 1, p. 949–962, 1913.

Statistics are given of domestic and world production and consumption of bauxite and aluminum in 1912 and previous years. Four processes advanced for the production of aluminum from clay are discussed.

8. The bauxite industry in the southern States [abs.]: Science, new ser., v. 39, p. 400–401, 1914.

In 1912, bauxite was mined in Arkansas, Alabama, Georgia, and Tennessee; total production for the year was about 160,000 long tons.

9. The production of bauxite and aluminum: U. S. Geol. Survey Min. Res. U. S., 1913, p. 1–27, 1914.

Statistics are given of domestic and world production and consumption of bauxite and aluminum in 1913 and previous years. The several mining districts of Tennessee, Georgia, and Alabama are described. The mining companies and the areas in which they operate are discussed by States.

10. The production of bauxite and aluminum: U. S. Geol. Survey Min. Res. U. S., 1914, pt. 1, p. 183–209, 1915.

Statistics are given of domestic and world production and consumption of bauxite and aluminum in 1914 and previous years. New processes for the production of alumina from clay are discussed. Mining areas are in Alabama, Arkansas, Georgia, and Tennessee. The operating companies and the mines are described.

11. Bauxite and aluminum: U. S. Geol. Survey Min. Res. U. S., 1915, pt. 1, p. 159–174, 1916.

Statistics are given of domestic and world production and consumption of bauxite and aluminum in 1915 and previous years. The British and Dutch Guiana bauxite deposits are briefly described. The mining companies and the areas in which they operated are discussed by States.

**Phillips, William B.**

(and Hancock, David). The commercial analysis of bauxite: Am. Chem. Soc. Jour., v. 20, p. 209–225, 1898.

In chemical analyses, the importance of discriminating between aluminum trihydrate and alumina present in some other form is stressed; and procedures for doing this are outlined. A new nomenclature is suggested: alumina soluble in 50° B sulfuric acid at 100° C during one hour is called "free alumina"; alumina soluble in sulfuric acid to fumes, "available alumina"; the difference between these, "combined alumina".

**Pinto, Mario da Silva.**

1. Bauxita: Brazil, Serviço Fomento Produção Min. Avulso, no. 24, 21 p., 9 figs., 1 pl. (index map), 1937; Mineração e Metallurgia, v. 2, no. 8, p. 145–157, 10 figs., Rio de Janeiro, 1937 [Portuguese, English summary].

The bauxite resources of the world and the origin of aluminous laterite and terra-rossa are briefly described. The industrial uses of bauxite and manufacturing processes are noted. Short descriptions of the bauxite deposits of Brazil include those in the States of Para, Maranhão, Bahia, Espírito Santo, Rio de Janeiro, São Paulo, and Minas Geraes. The largest are those on the Poços de Caldas Plateau along the boundary of the last two States listed; these are due to the weathering and laterization of the underlying nepheline rocks. Chemical analyses of the igneous rock and bauxite are included. An index map shows the location of all deposits.

2. Bauxita em Poços de Caldas (Est. de Minas Geraes), prospeção nos Campos da Fazenda do "Recreio": Brazil, Serviço Fomento Produção Min. Bol. 22, 71 p., 18 pls., Rio de Janeiro, 1938 [Portuguese].

The paper includes a general discussion of bauxite, the origin of bauxites and laterites, and the results of prospecting in six areas on the Poços de Caldas plateau with descriptions and chemical analyses of samples taken. The bauxite mantle in the area is about 3–5 meters thick; the overburden is about 30 centimeters thick and consists only of loose soil. The ore is considered to have been formed by the lateritization of the nepheline rocks which underlie a large part of the plateau. Reserves in the area studied are about 5 million tons, and, by extrapolation, reserves in the whole plateau are estimated to be roughly 160 million tons. In part 2 of the paper, areas for further prospecting are indicated, and the possibilities of an aluminum industry in Brazil are discussed.

3. Descoberto de ocorrencia de bauxita no Itatiaia: Mineração e Metallurgia, v. 3, no. 15, p. 183–185, 1 fig. (geol. sketch map), Rio de Janeiro, 1938 [Portuguese].

The discovery of bauxite in Itatiaia, Brazil, near Campo Bello is announced. The extent of the deposits and the geologic setting are briefly described.

**Plummer, John.**

Bauxite in New South Wales: Eng. Min. Jour., v. 73, no. 19, p. 763, 1902.

In 1899, bauxite was discovered in New South Wales about 100 miles south of Sidney. Almost simultaneously it was discovered in the Inverell and Emmaville districts in the northern part of the State. The bauxite varies in color from pale yellow to dark red. It has been used in making roads.

**Pobozsny, J.**

A verteshegység bauxittelepéi [Vertes Mts., Hungary]: Földt. szemle, Band 1, p. 215, Budapest, 1928 [Hungarian].

**Poiré, I. V. (Puare).**

1. Osnovnyye cherty sostava i stroyeniya tikhvinskikh boksitov i metodiki ikh izucheniya (Principal characters of structure and composition of the Tikhvin bauxites and of their investigation methods): Leningrad. geol.-gid.-geodez.-tresta Izv., nos. 2–3 (7–8), p. 69–71, 1935 [Russian, English summary].

A microscopic study of thin and polished sections and heavy mineral fractions of bauxite from the Tikhvin area showed the following minerals to be present: Gibbsite, boehmite, $\gamma$-diaspore, diaspore, corundum, hydrogoethite, hydrohematite, hematite, colloidal iron compounds, and two forms of kaolinite. In these bauxite deposits many different structures (porous, cellular, pisolitic, columnar, compact, shaly, and amygdaloidal) and textures (granular, meshlike, scaly, spotted, breccialike, etc.) are present.

2. Stroyeniye i sostav nekotor'ykh obraztsov Tikhvinskikh boksitov po rezul'tatam mikroskopicheskogo analiza (The composition and structure of some samples of the Tikhvin bauxites established by microscopic analyses): Leningrad. geol. tresta Trudy, vyp. 12, 53 p., 2 figs., 1936 [Russian, English summary].

This article reports a system of mechanical analysis devised for use with samples of bauxite from the Tikhvin area, Russia. Samples were separated into the following three or four size fractions: those greater than 0.05 mm in diameter, which consisted largely of quartz, feldspar, magnetite, hydrogoethite, hematite, and heavy minerals; those between 0.05 and 0.01 mm in diameter, which consisted chiefly of gibbsite and kaolinite, with some heavy minerals, and rarely quartz and feldspar; those less than 0.01 mm in diameter which were also chiefly gibbsite and kaolinite with mica and some heavy minerals. Those between 0.005 and 0.001 mm in diameter were also separated out. A study of the 0.05 to 0.01 mm fraction indicated four types of bauxite: (1) hydrogoethite-gibbsitic; (2) hematite-gibbsitic; (3) hydrogoethite-kaolinite; and (4) hematite-kaolinite. However, a study of the minerals with a definite index of refraction but with diameters less than 0.01 mm showed the following four types of bauxite: (1) boehmite-kaolinite; (2) boehmite-gibbsitic; (3) gibbsite-diaspore-boehmitic; and (4) gibbsite-boehmite-diasporic.

**Polutoff, N.**

Die Bauxitvorkommen Russlands: Metallwirtschaft, Band 16, no. 31, p. 757–759, 1937 [German].

**Polyanin, V. A.**

Mineralogiya i genezis mezozoyskikh boksitov vostochnogo skolna Urala [Mineralogy and the genesis of the Mesozoic bauxites of the eastern slope of the Urals]: Kazan'. gosudar. univ. Uchenyye zapiski geol., tom 98, kniga 5–6, geol. vyp. 11–12, p. 153–210, 7 figs., 2 pls., 1938 [Russian].

**Posewitz, Theodor.**

1. Das Lateritvorkommen in Bangka: Petermann's Mitt., Band 33, p. 20–25, 1887 [German].

The laterites of the Island of Bangka, in the Netherlands Indies [Indonesia] are described and are classified as primary or detrital.

2. Lateritvorkommen in West-Borneo: Naturk. tijdschr. Nederlandsch Indië, Deel 48, p. 16–19, 1889 [German].

**Posnjak, E.** *See* Merwin, H. E.

**Pough, Frederick H.**

Aluminum: Nat. History, v. 50, no. 5, p. 244–246, 2 figs., 1942.

This is a nontechnical account of the various aspects of the aluminum industry, the reserves of bauxite and other sources of aluminum, the origin of the deposits, the location of the most important mining areas in the world, processing of the ore into aluminum metal, and other uses of bauxite, such as aluminous cement, refractory brick, and abrasives.

**Powell, W. Byrd.**

A geological report upon the Fourche Cove and its immediate vicinity: Antiquarian Nat. History Soc. Ark., 22 p., 1 map, 1842.

The bauxite deposits of Fourche Cove, Ark. are described on pages 11–13. Although not recognized as bauxite, these deposits were recognized as a distinct formation and were called "amygdaloid". They are described as resting on the greenstone and are considered to belong possibly to the "trap family."

**Powers, W. L.**

(and Elizalde, Luis Ma. de). The leached red soils of northern Venezuela: Soil Sci. Soc. America Proc., v. 8, p. 396–402, 9 figs. (incl. soils map), 1943.

The red soils of northern Venezuela are not high in alumina although the concretions, which tend to accumulate near the surface, contain as much as 70 percent of iron oxide.

**Pratt, Joseph Hyde.**

Aluminum and bauxite: U. S. Geol. Survey Min. Res. U. S., 1900, p. 229–231, 1901.

Domestic production of aluminum is given for the years 1883–1900; imports, for 1870–1900; and domestic bauxite production, for 1899–1900.

**Priddy, Richard Randall.**

(and McCutcheon, Thomas Edwin). Pontotoc County mineral resources: Miss. State Geol. Survey Bull. 54, 139 p., 1 pl., 15 figs. (incl. geol. maps), 1943.

*Bauxite, bauxitic, and kaolinitic clays, p. 50–53; 109–123.*—Although previous tests have shown the bauxite of Pontotoc County is too high in iron and silica for use as an aluminum ore, one deposit capping a small hill 9 miles west of Pontotoc

appears to have a lower iron content. Bauxitic clay occurs northwest of Thaxton, east of Toccopola, and west and northwest of Randolph. Thicknesses and extent of these deposits are shown on a table. Physical properties and chemical analyses are given. The bauxite deposits described in this bulletin are only those discovered in the county after the publication of Bulletin 19, by P. F. Morse in 1923.

**Pringle, L. B.**

Bauxite in Arkansas: Ark. Mineralog. Soc. Bull. 2, p. 2–4 and 8, 5 figs., June 1945.

A nontechnical account of the geologic occurrence and origin of bauxite in Arkansas. Mining and metallurgy are briefly treated.

**Protescu, O.**

Bauxite deposits of the regions of Schodol (Jud. Alba) and Vidra (Jud. Turda), Rumania: Inst. geol. Românie, Studii tech. econ., ser. A, no. 1, 23 p., 1938.

**Prouteau, J.**

La bauxite gisements—exploitation, usages: Mines, carrières, tome 8, no. 80, p. C61–65, 1929, Paris [French].

The bauxite deposits of Var and Bouches-du-Rhône, France, are described, and the mining methods and commercial uses for the ores are discussed.

**Purdue, A. H.**

1. Bauxite in Tennessee: Tenn. Geol. Survey Min. Res. Tenn., v. 4, no. 2, p. 87–92, 1 fig. 1914.

The physical and chemical characteristics of bauxite are stated briefly in nontechnical language. It is noted in a short history of the Dobson bauxite mine, near Elizabethton, Carter County, that it was opened by the National Bauxite Co., in 1912. The same company had opened the mine at Chattanooga in 1906.

2. Bauxite: Mineral Industry, 1916, v. 25, p. 42–47, 1917.

Statistics are given of domestic production by States, imports, and consumption, 1907–16, and of world production, 1912–16. Operating companies and producing mines are listed and described by States. There are brief sections on bauxite in foreign countries, and the uses of bauxite.

**Puscarin, V.**

(and Motås, C. L. L.). Les gisements de bauxite des monts du Bihor: Analele min. România 3e année, no. 2, p. 115–122, 4 figs., 1920 [French and Romanian].

The bauxite deposits of the Bihar Mountain area, Rumania, occur along an irregular surface on limestones of Jurassic age. The deposits are lenticular and appear to have been faulted. Chemical analyses show 50–70 percent alumina. The reserves of the district are estimated to be 10 million metric tons of probable ore and an additional 20 million tons of possible ore. The two main types of bauxite are designated the red and the white. The deposits appear to be relatively small and discontinuous. In most places they are overlain by limestone several times thicker than the bauxite itself.

**Quitzow, Hans Wilhelm.**

Die geologische Stellung der Ostadriatischen Bauxitvorkommen: Zeitschr. prakt. Geologie, 52 Jahrg., Heft 2, p. 11–19, 8 figs. (incl. sketch maps and sections), 1944 [German].

The stratigraphy and structure of the bauxite deposits of the eastern Adriatic are described and shown on small scale maps and cross sections. The deposits shown on a map of the whole area are differentiated by symbols as Triassic, Cretaceous, early Tertiary, or late Tertiary in age. The deposits in northern Dalmatia and in the vicinity of Mostar, Yugoslavia, are described in greatest detail.

**Radhakrishna, B. P.** *See* Ramachandra Rao, M. B.

**Raggatt, H. G.**

1. Australia's mineral industry in the present war: Royal Soc. New South Wales Jour. and Proc., 1943, v. 77, pt. 2, p. 52–84, 16 figs., Sydney, 1944.

In eastern New South Wales, proved reserves amount to 15 million tons of bauxite containing 34–45 percent alumina and 1.7–5.5 percent silica. The deposits occur in two main groups—the Emmaville-Inverell, and the Bundanoon-Wingello. In Victoria there are proved reserves of more than 650,000 tons of bauxite, of which 500,000 tons averages 52 percent alumina and 5 percent silica. The most important deposits are in the Mirboo-North Boolarra district. Much undiscovered ore may exist in this area. Here the bauxite deposits lie on an erosion surface on the Older Basalt and are overlain by lignites. In both States the deposits are easily accessible. They have little or no overburden in the New South Wales districts, and in Victoria the ratio of ore to overburden is less than 4 to 1.

In Tasmania a proved reserve of 500,000 tons averages 41.2 percent "free" alumina and 3.2 percent silica. The average thickness of the deposits is about 8½ feet; the overburden is about 3½ feet thick. The most important area is the Ouse Valley, although other areas are known.

2. (Owen, H. B., and Hills, E. S.). The bauxite deposits of the Boolarra-Mirboo North Area, South Gippsland, Victoria: Australia Min. Res. Survey, Bull. 14 (Geol. ser., no. 5), 65 p., 19 pls. (incl. geol. maps), 1945.

Twelve new bauxite deposits were discovered in South Gippsland, bringing the total known in the area to 24; these are described individually. Reserves of 5 deposits studied in detail are estimated to amount to 735,500 long tons, averaging 51.3 percent alumina, 7.66 percent silica, 7.2 percent ferric oxide, and 5.5 percent titania. The largest deposit contains 214,000 long tons of relatively high-grade and 165,000 long tons of relatively low-grade bauxite. All except possibly 2 of the deposits overlie, or are only a short distance above, the Older Basalt and are overlain by the Yallourn formation. The deposits are considered to be Oligocene or lower Miocene in age. The bauxite was probably derived from the alteration of these basaltic tuffs, or basalts.

3. (Ney, P. B., and Fisher, N. H.) The mineral resources and the industries of the Commonwealth of Australia and the Mandated Territory of New Guinea: Australian Inst. Mining and Metallurgy (Inc.), Proc., no. 143, p. 188–282, 1 pl., 1946; repr., Australia Bur. Min. Res., Geology and Geophysics.

In this general review of the mineral resources of Australia and the Mandated Territory in New Guinea, the discussions of commodites are arranged in alphabetical order and include the location of known deposits and mining districts, grade of ore, estimates of reserves where possible, and production figures. The résumé on bauxite appears on page 199.

**Ragozin, L. A.**

Novyy boksitonosnyy rayon Sibiri [The new bauxite-bearing district of Siberia]: Razvedka Nedr, no. 10, p. 18–22, Moscow, 1938.

"Describes a newly discovered bauxite district on the northern slope of the Kuznetsk Alatau, Siberia."—*V. 7, 1939.

**Rakusz, Gyula.**

Adatok a Harsány-Hegy bauxitzintjének ismeretéhez—Beitrage zur Kenntnis de Bauxit niveaus des Harsanyberges: K. Ungarische geol. Anst. Jahresber. (Magyar kir. földt. intézet Évi jelentései), 1929–32, p. 215–233, 2 figs., geol. map 1:12,500, 1937 [Hungarian, German summary].

The bauxite deposits in the Harsany Mountains, Hungary, are shown to occur along an unconformity between Jurassic and Cretaceous limestones. The strata dip steeply southward. The bauxite, 8–10 meters thick, crops out in a gentle, discontinuous arc extending about 1,900 meters in a roughly north-south direction. Chemical analyses of 58 samples are included.

**Ralston, Oliver C.**

(and Nicolai, E. R.). War focuses attention on Southeast's nonmetallics: Manufacturer's Rec., v. 113, no. 10, p. 52–53 and 78–80, 4 figs., 1944.

A short section on bauxite is included in a résumé of the mineral resources of the southeastern United States. Considerable tonnages of marketable bauxite exist in these States. Much lower grade material exists and was being studied at the U. S. Bureau of Mines laboratories in 1944 in an effort to perfect an economic method of recovery of alumina from it.

**Ramachandra Rao, M. B.**

(and Radhakrishna, B. P.). Report on the prospecting for bauxite near Shivaganga Holalkere Taluk [India]: Mysore Geol. Dept. Rec., v. 38, 1939, p. 106–115, 3 pls. (incl. geol. map 1:31,700), 1940.

The bauxite deposits near Shivaganga, India, are siliceous. Reserves for the entire area are estimated to be about 97,600 tons. The average alumina content is not more than 38 percent; beneficiation would probably raise this to 40 percent alumina. It is suggested that such material could be used for refractory bricks, in decolorizing oils, and the manufacture of aluminum sulfate.

**Range, Paul.**

Der Bergbau der deutschen Schützgebiete in Africa und in der Südsee unter. besonderer Berücksichtigung des Erzbergbaues: Metall u. Erz, Jahrg. 38, Heft 10, p. 213–221, 5 figs., 1941 [German].

The mineral resources of Togo, Cameroons, German East Africa, German Southwest Africa, and the south seas are briefly described. Past production of the more important ores is included. Small-scale maps of the countries show location of deposits; bauxite occurs only in Togo, Cameroons, and the Palau Islands in the Pacific Ocean, and had been mined only on Palau.

**Ranjan, P.** *See* Chhibber, H. L.

**Rao, T. V. M.**

1. A study of bauxite: Mineralog. Mag., v. 21, no. 120, p. 407–430, 6 figs., 1928.

The literature on nomenclature of bauxite and laterite and on the process of laterization is reviewed. The author experimented with solutions of (1) sulfuric

acid, (2) alkali carbonates, (3) carbonic acid, and (4) distilled water, which were continuously passed through samples of crushed basalt for 9 months, after which the basalt was analyzed for changes. The author concludes, as a result of this work, that laterization is probably largely due to the action of alkali carbonate solution. Laterites in India, British Guiana, the Gold Coast, Ireland, and France are briefly described.

2. Bauxite from Kashmir: Mineralog. Mag., v. 22, p. 87–91, 1929.

The bauxite deposits in Jammu in Kashmir occur as a bed 7–10 feet thick overlying the "Great Limestone" but separated from it by a thin zone of siliceous breccia. The bauxite is overlain by the Sabathu coal beds of Eocene age, and grades laterally into clay or into coal beds. The texture of the bauxite is massive or spherulitic. In thin section, most of the material is opaque, but a few clusters of diaspore crystals were identified. Ilmenite, anatase, hematite, and limonite were seen in small amounts. Chemical analysis showed the rock to be highly refractory, and to contain about 62–81 percent alumina, 0.8–14.0 percent silica, and 12–15 percent loss on ignition. It is considered that the monohydrate present in the samples as opaque material is largely boehmite, although X-ray analyses were not available, and that diaspore is present only in minor amounts.

**Redfield, R. C.**

Bauxite and aluminum: Tex. Univ., Bur. Econ. Geology, Min. Res. Circ. 18, 19 p., 1942.

This résumé includes a general discussion of the various ores of aluminum, the origin and mode of occurrence of bauxite, its mining, beneficiation, production and consumption, foreign and domestic resources, uses, and the aluminum industry.

**Reed, A. H., Jr.** *See* Malamphy, Mark C.

**Reed, Donald F.**

Bauxite deposits of Tippah and Benton Counties, Miss.: U. S. Bur. Mines Rept. Inv. 4281, 16 p., 7 figs., 1948.

Low-grade bauxite and bauxitic clay deposits, known to occur along the Midway-Wilcox contact in Tippah and Benton Counties, were drilled during 1941 and 1942. Most of the bauxite consists of a clay-ball conglomerate in which gibbsite occurs as a thin shell around some of the clay balls. The material is, in some places sandy and is high in iron. Chemical analyses of the cores, together with data on thickness of overburden, etc. are included in a table. The five areas studied and locations of drill holes are shown on large-scale maps. The areas are briefly described.

**Rettger, R. E.**

The bauxite deposits of southeastern Ala.: Econ. Geol., v. 20, no. 7, p. 671–686, 3 figs., 1925.

The bauxite deposits in Barbour and Henry Counties occur in a small area about 13 miles southwest of Eufaula. They lie on the irregular contact between the Midway and overlying Wilcox formations. The bauxite occurs as pockets in the Midway. The origin of bauxite is suggested as due to the subsequent alteration of very pure clays derived from the weathering of the crystalline rocks of the Piedmont and deposited in lagoons and lakes. The alteration probably occurred during the erosion interval between Midway and Wilcox time by the action of ordinary solutions containing some carbonic or humic acid which removed silica from the clay.

**Retzlaff, A.**

Deutscher bauxit: Dinglers polytech. Jour., Band 229, p. 273, Berlin, 1878 [German].

**Richards, J. W.**

Aluminum: Mineral Industry, 1917, v. 26, p. 10–29, 1918.

Statistics on domestic production of bauxite by States, imports, and consumption include the years from 1908 to 1917. The bauxite deposits of the United States and the mining companies are discussed. There is a short section on foreign deposits. World production statistics are given for 1913 to 1917.

**Richardson, J. A.**

Bauxite formed in situ in alluvium, and lateritization of alluvium and limestone in the Mae Khlaung and Khwae Noi Valleys, Siam: Inst. Min. Metallurgy, Bull. 490, p. 13–17, 1 fig., 1947.

In the alluvium-filled Mae Khlaung valley a bauxite deposit has been exposed in the wall of the gorge 5 to 6 miles down river from Kan Buri. The bauxite is at least 6 feet thick, but the areal extent is unknown, although similar material has been found elsewhere in the valley alluvium. The deposit is "crowded with raggy and irregularly-shaped nodular concretions of pale grey and dirty-white bauxite." The bauxite is considered to have formed in place during a period of elevation and monsoon climate.

**Richter, Gehard.**

Über die Bauxite der Provence: Zeitschr. prakt. Geologie, 38 Jahrg., Heft 4, p. 75–78, 4 figs., 1930 [German].

The geology of Provence, France, and the relation of the bauxite deposits to it are briefly presented. The transgression of the Late Cretaceous sea in the area and the location of the Provence swell are shown to explain why the bauxite, although formed during a single erosion interval, does not everywhere occur at the same stratigraphic horizon. Subsequent diastrophism has severely faulted and folded the bauxite beds, so that they are discontinuous and in places steeply dipping.

**Ries, Heinrich.**

The occurrence of aluminum hydrate in clays: Econ. Geology, v. 9, p. 402–404, 1914.

The author discusses a paper by M. G. Edwards, The occurrence of aluminum hydrates in clays (see Edwards, M. G.), and points out the several reasons why errors may occur if the mineralogic composition of clays is deduced from chemical analyses only.

**Riker, O. Pery.**

Mineral position of the E. C. A. nations—No. 11, Greece: Eng. Min. Jour., v. 150, no. 1, p. 65–66, 1 fig., 1950.

This is a general paper on the status of all types of mining in Greece. It is accompanied by an index map showing by symbols the location of mineral deposits and the 1938 production of districts.

**Robertson, Percival.**

Implications of a cobble of bauxite found in the LaFayette gravel of St. Louis County [Mo.] [Abs.]: Mo. Acad. Sci. Proc., v. 6, p. 80–81, 1941.

A cobble of bauxite about a foot in diameter was found about midway from the top in a deposit, 30 feet thick, of LaFayette gravel. The source of the cobble is unknown.

**Robertson, Thomas.**

Report on the geology of western Togoland, West Africa: Gold Coast Geol. Survey Dept. Rept., 52 p., maps, introd., Accra, 1921.

*Laterite in Togoland, p. 40–41.*—The deposit on Agu mountain, examined by A. E. Kitson, is the only known bauxite deposit in the country. The material is pisolitic; some of these are as much as a quarter of an inch across and are opaque, dark red, concentric with a septarian structure. There are also small pisolites of cryptocrystalline gibbsite. Other deposits of laterite in Togoland are impure and high in iron and silica. Such deposits are not confined to any particular type of underlying rock.

**Rodgers, John.** *See* King, P. B.

**Rodrigues, G.** *See* Hardy, F.

**Romslo, T. M.** *See* Malamphy, Mark C.

**Ross, Clarence S.**

Geochemistry—Clays and soils in relation to geologic processes: Wash. Acad. Sci. Jour., v. 33, p. 225–235, 1943.

The paper is largely on the formation and mineralogy of clay minerals, as the title indicates, but the relationship between the kaolin, bauxite, secondary iron carbonate, and lignite beds in Arkansas are briefly discussed.

**Roth, Albert.**

Der Einfluss der kristallinen Struktur der Bauxite auf ihre Aufschliessbarkeit nach dem Bayer-Verfahren: Metall u. Erz, 35 Jahrg., Heft 17, p. 447–450, 3 figs., 1938 [German].

A study was made of 23 samples of bauxite from Greece, Hungary, Rumania, Yugoslavia, Italy, France, South America, and India. Chemical analyses and X-ray analyses using the Debye-Scherrer method were made. The X-ray method offers a quick way of determining whether a bauxite is primarily of boehmite or gibbsite, which can be used in the Bayer process, or of diaspore, which can not. Mixtures of these three minerals can also be detected.

**Roth von Telegd, Károly.**

1. A Dunátúl bauxittelepei: Földt. szemle, 1 kőtet, 2 fűzet, p. 95–103, 1 fig., Budapest, 1922 [Hungarian].

The bauxite deposits along the Danube River, in southern Hungary, are described.

2. Die Bauxitlager des Transdanubischen Mittelgebirges in Ungarn: Földt. szemle, Band 1, Heft 1, p. 33–45, 3 figs. (incl. geol. sketch maps), Budapest, 1927 [German].

The trans-Danubian bauxite deposits in the Halimba district of the Bakony Mountains and in the Vertes Mountains, Hungary, overlie the upper Triassic Hauptdolomit beds. The bauxite is generally overlain by Eocene sediments.

It occurs in relatively flatlying beds which may be 10–20 meters thick. A typical analysis shows approximately 58 percent alumina, 4 percent silica, 3 percent titania, 16 percent iron oxide, and 18 percent water. The age and mode of formation of the deposits are also discussed.

3. Megjegyzések pobozsny istván "A vérteshegység bauxit-telepei" címíí ertekezéséhez: Magyar földt. társulat Földt. közlöny, kötet 59, p. 63–64, Budapest, 1930 [Hungarian].

4. Jelentés az 1930 és 1931 években a Bakony hegységben és a Villányi hegységben végzett bauxitkutatásokoról—Bericht über die in den Jahren 1930–1931 im Bakony- und im Villányer-Gebirge durchgeführten Bauxitforschungen: K. Ungarische geol. Anst. Jahresber. (Magyar kir. földt. intézet Évi jelentései), 1929–1932, p. 197–213, 2 figs., Budapest, 1937 [Hungarian, German summary].

The paper records the results of the author's work in the northern Bakony region, Hungary, during 1930 and 1931, in the Tés and the Alsópere-Esplény districts. Near Tés no traces of bauxite were found either where the Triassic deposits (Hauptdolomit and Dachsteinkalk) are overlain by a loess deposit or where the upper Triassic is transgressed by marine deposits of the lower Lias (Lower Jurassic) series (Aptian-Albian). However, near Alsópere the latter formation marks the bauxite horizon. Bauxite is also reported in the Tunyok Mountains and from Esplény northward to the Boszorkány Mountains. On the northwest side of the Tunyok Mountains these beds dip 10°–15°, but in the northern part of the Boszorkány Mountains the dip is 35°–40°. Bauxite also occurs in the Villany and the Harsany Mountains, Hungary.

**Roule, Lewis.**

Sur les gisements et l'âge de la bauxite dans le sud-est de la France: Acad. sci. Paris Comptes rendus, tome 104, p. 383–385, 1887 [French].

In southeastern France, there is no single bauxite horizon recognized, but the deposits occur in a lacustrine series which in that region marks the termination of the Cretaceous. The bauxite occurs between the *Lychnus* beds (Danian) and lignites (upper Senonian). The bauxite is considered to have been deposited in a lake.

**Rowland, Richards A.** *See* Grim, Ralph E.

**Rozhkova, Ye. V.**

1. (and Solov'yev, N. V. [Soloviev]). Eksperimental'noye izucheniye usloviy obrazovaniya bobovykh zhelezo-aluminiyevykh rud (An experimental study of the conditions of formation of pisolitic iron-aluminum ores), *in* Boksity, tom 1—Mestorozhdeniya boksitov, prirochenniye k mezozoyskim otlozheniyam (Bauxites, v. 1—Bauxite deposits confined to the Mesozoic, pt. 2): Vses. nauch.-issledov. inst. mineral'nogo syr'ya Trudy, vyp. 111, p. 205–216, 230–231, 1 fig., 1 pl., Moscow-Leningrad, 1936 [Russian, English summary].

Upon adding small amounts of ammonia or some other alkali to a mixture of iron and aluminum salts in solution, it was found that hydrates were obtained consisting wholly of pea-shaped corpuscules. The small corpuscules joined to form larger aggregates. An increase in alkalinity of the solution immediately

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after their formation brings about a complete return to a structureless gel. However, 10 to 15 hours after precipitation, this does not happen. These pea-shaped corpuscules were obtained for various salts of aluminum, ferric and ferrous oxides, and manganese. The outer part of the corpuscule is like a fine shell, lighter in color than the inner part.

If the pH value of the solution during precipitation varies from 2.52 to 2.15, that of the corpuscules varies from 4.0 to 3.25.

2. (and Soboleva, M. V.). Mineralogiya i usloviya obrazovaniya bobovykh zhelezo-alyuminiyevykh rud (The mineralogy and conditions of formation of pisolitic iron-aluminum ores), *in* Boxity, tom 1—Mestorozhdeniya boksitov, priurochennyye k mezozoyskim otlozheniyam (Bauxites, v. 1—Bauxite deposits confined to the Mesozoic, pt. 2): Vses. nauch.-issledov. inst. mineral'nogo syr'ya Trudy, vyp. 111, p. 145–204, 228–230, 5 figs., 2 pls., Moscow-Leningrad, 1936 [Russian, English summary].

The study was made on material from the Middle and Southern Urals, northeast Kazakhstan and the Eniseisky taiga (eastern Siberia). The alumina is present largely as gibbsite; diaspore was indicated in two specimens by thermal analysis. Both the alumina and iron probably occur partly as gels inasmuch as the water content is too low to account for all the alumina and iron as hydrates. Formation of pisolites is considered to have probably taken place as a result of precipitation of colloidal aluminum and iron from hydrosols and true solutions at the bottom of lakes, marshes, etc. Experiments in the formation of pisolites in the laboratory are described. Structures closely resembling pisolites were obtained by slowly adding an ammonia solution or other alkali to acid solutions containing ferrous, ferric, and aluminum salts. The pH of the medium at the first appearance of pisolites varied from 2.5 to 3.0. They were then transparent and unstable. When the pH is slowly raised to 4 or 7, they become heavy and stable. In case of a rapid change to pH 7, the corpuscules disappear and are converted to a structureless gel. The addition of a certain amount of soluble glass to the solutions imparts a greater stability. Drying in air usually lead to decomposition of pisolites. They acquire magnetic properties when the solutions contain ferrous salts.

3. (and Soboleva, M. V.). K mineralogii paleozoyskikh boksitov mestorozhdeniya severnogo Urala (On the mineralogy of the Paleozoic bauxites), *in* Boxity, tom 3 (Bauxites, v. 3): Vses. nauch.-issledov. inst. mineral'nogo syr'ya Trudy: vyp. 120, p. 3–23, 66–68, 6 figs., 3 pls., Moscow-Leningrad, 1938 [Russian, English summary].

The mineralogy of the Ivdel, the Krasnaya Shapochka, and the Bogoslovsk bauxite deposits has been studied in detail. Diaspore, hydrohematite, chlorite, and daphnite were identified by X-ray analysis, but boehmite and quartz were not found. Titanic iron ores, sphene, and rutile were seen in thin sections. It is considered that the bauxite consists of variable proportions of a complex gel of silica, alumina, and titanium, and of a chlorite gel, parts of which are crystalline diaspore or chlorite. The deposits at Ivdel are dark green in color and contain much chlorite; those at Krasnaya Shapochka are red and consist primarily of diaspore and hydrohematite.

4. Mineralogiya i usloviya obrazovaniya paleozoyskikh boksitov i zhelezo-alyuminiyevykh rud Urala (Mineralogy and conditions of formation of Paleozoic bauxites and iron-aluminum ores of the Urals), *in* Boxity, tom 3 (Bauxites, v. 3): Vses. nauch.-issledov. inst. mineral'nogo Syr'ya Trudy, vyp. 120, p. 47–65, and 70–74, Moscow-Leningrad, 1938 [Russian, English summary].

On the eastern slopes of the Urals, bauxite deposits of Paleozoic age are found in strata of Upper Silurian and Lower Devonian ages; but on the western slope, they occur only at the base of the Upper Devonian and in the upper part of the Frasnian. This paper is a résumé of the bauxite deposits of Paleozoic age in the Ural Mountains, U.S.S.R. and gives the location, mineral composition, and a brief description of each district.

**Rozlozsnik, Paul.**

1. Vorläufiger Bericht über die Art des Auftretens der Bauxite in nördlichen Bihar (Királyerdö): K. Ungarischen geol. Reichsanst. Jahresber. 1916, p. 506–510, Budapest, 1920 [German translation of Hungarian original *in* Magyar k. földt. intézet Évi jelentései].

The occurrences of bauxite in the northern Bihar district, Hungary [now Rumania], are briefly described. Reserves of known deposits were estimated to be 10,000–20,000 tons.

2. Notizen über das Vorkommen von Bauxit im Pojana-, Ruszka- und im sudlichen Bihar-Gebirge: K. Ungarischen geol. Anst. Jahresber. 1917–1924, p. 201–208, 1 fig., Budapest, 1934 [German translation from Hungarian original in Magyar k. földt. intézet Évi jelentései].

Bauxite occurs in the Pojana-Ruszka area and in the southern Bihar Mountains, Rumania. Chemical analyses show that alumina content of the bauxite is a little greater than 50 percent in these deposits. They are considered to be Cretaceous in age.

**Rumbold, W. G.**

Bauxite and aluminum: Imp. Inst. Mon. min. res. 110 p., 1 fig., London, 1925.

Chapter I, Bauxite and aluminum, includes a general résumé of the properties, preparation, uses and marketing of bauxite. The other two chapters describe the occurrences and major areas of bauxite in the world. The information is largely a compilation from the literature.

**Rumpelt, H.**

Die Bestandteile der Bauxitrotherde aus den Lagern bei Bodayk (Ungarn): Metall u. Erz, 29 Jahrg., Heft 22, p. 471–474, 4 figs., 1932 [German].

X-ray analysis of the red bauxite from Bodayk, Hungary, showed the iron oxide to occur as the mineral goethite, and the aluminum oxide, as bauxite [boehmite].

**Ryasanov, V. D.** *See* Tumanov, S. G.

**Saint-Smith, E. C.**

Lateritic deposits near Charters Towers [Australia]: Queensland Govt. Min. Jour., v. 22, p. 359–360, Brisbane, 1921.

The reddish mesas in the vicinity of Charters Towers goldfield are shown to be material altered in place from the underlying granodiorite. At the surface, the bulk of the weathered material is kaolinite and much stained by iron oxide. The material grades downward into decomposed granodiorite. Angular quartz grains, similar in outline to those in the fresh rock, and traces of veining and jointing, relict structures from the original rock, occur throughout. One sample analysed in 1913 showed 8.6 percent iron oxide, 22.7 percent alumina, and 59.6 percent silica. The deposits are considered to be remnants of a formerly much more extensive blanket.

**Sakamoto, Toshio.**

Origin of bauxite: Geol. Soc. Tokyo Jour., v. 40, nos. 478–479, p. 431–442, 495–516, 1 fig., 1933 [Japanese].

**Salmojraghi, Francesco.**

Esiste la bauxite in Calabria: R. inst. lombardo sci. Rend., ser. 2, v. 33, p. 252–261, 1900 [Italian].

This is an evaluation of papers that have mentioned the existence of bauxite in Calabria, Italy.

**Salques, René.**

Les bauxites françaises: 11 p., Brignoles sta. bot., Lab. minéralogie, 1929 [French].

Chemical analyses indicate that bauxite is an amorphous rock, essentially heterogeneous, characterized by the monohydrate of aluminum and such variables as aluminum silicates and oxides of iron and titanium. In France, bauxite occurs in Ariège, Hérault, Bouches-du-Rhône, and Var; many analyses of these ores are included.

**Sampelayo, Primitivo Hernandez.**

1. Condiciones geológicas de los yacimientos Catalanes de bauxita: Inst. Geol. España Bol., ser. 3, tomo 1 (or tomo 41), p. 3–147, 4 figs., 11 pls., 1 map, 1920 [Spanish].

This paper is a comprehensive description of the bauxite deposits of Catalonia, Spain. They occur as scattered, irregular-shaped deposits in sediments of lower Eocene marine and terrestrial facies, and in limestones of Triassic age near Mediona and La Llacuna. The deposits are concealed by debris but are not overlain by heavy overburden. Each of the known deposits is described in detail. A study of the orogenic history of the area indicates: (1) that a relationship exists between the bauxitic deposits and downwarping following the Mesozoic; and (2) that the extension of the Spanish deposits must be toward Teruel and the Levantine Provinces, where the same geologic horizon and identical deposition occur. The formation of laterite and of bauxite deposits is discussed. Microscopic study of the bauxite showed the presence of iron oxides, aluminum hydrates, tiny stringers of calcite, and clusters of a micaceous mineral and hydrargillite. The deposits are shown on a colored geologic map of the Catalonia area, scale 1:40,000. The bauxite deposits and the aluminum industry of the rest of the world are described by countries.

2. Geologia y formacíon de los criaderos Catalanes de bauxita: Rev. minera, metalúrgica y ingeniería, año 71, p. 193–198 and 209–211, Madrid, 1920 [Spanish].

**Sanford, Robert S.**

Investigation of certain high-alumina clays of central Pennsylvania: U. S. Bur. Mines Rept. Inv. 4427, 12 p., 4 figs., 1949.

Flint clay and nodular oolitic diaspore clay occur in Pennsylvania mainly in Clearfield County but also in Cambria, Centre, Clarion, Clinton, Indiana, Jefferson, Somerset, and Westmoreland Counties. The deposits are a part of the Pottsville series of Pennsylvanian age and may be from 5 to 25 feet thick. During the course of the investigation, 12 test pits were dug, and 53 drill holes were cored. Chemical analyses of much of the cored material are included.

**Sastri, B. N.**

Platinum in Dhangawan (Jubbulpore district, C. P.) bauxite: Jour. Sci. Indus. Research, v. 6, no. 6, ser. B, p. 82, 1947.

A note on the history of the discovery of platinum in bauxite in the Jubbulpore district, India.

**Saville, Shaw.** *See* Murton, Charles J.

**Schadler, Josef.**

Ein neues Bauxit-Vorkommen in Oberösterreich: Austria, Geol. Bundesanst. Verh., Heft 7–9, p. 136–137, Vienna, 1948 [German].

The discovery of a new bauxite deposit 3 kilometers northeast of Strobl, northern Austria, is reported. The ore is dark red-brown and oolitic. Chemical analysis shows 51.71 percent alumina, 8.01 percent silica, 20.91 percent iron oxide, and 2.50 percent titania.

**Schmedeman, O. C.**

1. Caribbean aluminum ores: Eng. Min. Jour., v. 149, no. 6, p. 78–82, 4 figs., 1948.

Aluminum ores were discovered in Jamaica in 1942, in Haiti in 1943, and in the Dominican Republic in 1944. Reserves are estimated to be approximately 350 million tons of which about 90 percent is in Jamaica. Ores are not indurated but resemble red soil, are very permeable, and show little variation from place to place, or top to bottom. Chemical analyses also show great uniformity: silica, 2 percent; alumina, 47–52 percent; iron oxide 15–25 percent; and water 18–30 percent. The deposits overlie a pure limestone from which the author suggests they were derived, accumulating in depressions in the karst surface. The deposits vary in thickness from a few inches to over 100 feet, and in size from a few thousand tons to tens of millions.

2. First Caribbean bauxite development * * * will strengthen American security by providing a nearer source, with abundant reserves: Eng. Min. Jour., v. 151, no. 11, p. 98–100, 2 maps, 2 figs., 1950.

The mining operations of the Reynolds Jamaica Mines, Ltd., a subsidiary of the Reynolds Metals Co., are restricted to an area of about 10,000 acres in the eastern part of the Parish of St. Ann, Jamaica, and about 6 miles inland from Ocho Rios Bay, the shipping port to be used on the northern coast of the island. The deposits lie at altitudes of from 1,100 to 1,500 feet filling shallow basins on a generally flat limestone plateau. The seaward edge of the plateau terminates in a steep bluff nearly 1,000 feet high. It is planned to transport the ore overland and down the bluff to storage silos by means of aerial ropeways, and out onto the pier for loading by a conveyor belt. The small harbor can accommodate ocean-going vessels with as much as a 35-foot draft. A new 13,150-ton self-loading ship is being built for this haul.

**Schréter, Z.**

Der alaunhaltige Brunnen von Gant: Magyar földt. társulat. Föld. közlöny, kötet 40, füzet 3–4, p. 277–283, 2 figs., 1910 [German].

Alumia-bearing springs in the vicinity of Gant, Hungary, are discussed with relation to the formation of deposits of bauxite as well as alum.

**Schulten, A. de.**

Reproduction artificielle de l'hydrargillite: Soc. Française minéralogie Bull., tome 19, p. 157–161, 1896 [French].

Crystalline hydrargillite was obtained by dissolving 25 grams of commercial aluminum in 75 grams of caustic soda and 400 cc of water, and evaporating it slowly until crystals precipitate out. Chemical analyses of these crystals show 64.47 percent alumina, 34.76 percent water, and 0.53 percent silica. The crystals of hydrargillite thus obtained are monoclinic, and the p(001), the h(110), and the m(110) faces were developed. They are about 0.3 mm long and 0.12 mm wide. The crystal angles were measured, and the extinction angle of about 20° was observed.

**Schwiersch, Hermann.**

Thermischer Abbau der natürlichen Hydroxyde des Aluminiums und des dreiwertigen Eisens: Chem der Erde, Band 8, p. 252–315, 15 figs., 1933–34 [German].

Thermal dehydration, X-ray, and optical studies were made of diaspore, boehmite, hydrargillite, goethite, limonite, and lepidocrocite. Some of the results are as follows: Diaspore and boehmite show a close similarity in thermal dehydration. Lepidocrosite is the same as rubinglimmer. Limonite shows a lower dissociation temperature than goethite. The partial desiccation of hydrargillite was found to form boehmite. The crystallographic orientation of the oxide and hydroxide formed in the laboratory is the same as that of material formed in nature. This comprehensive laboratory study emphasizes the effects of changes in temperature or dehydration in causing the mineral to change from one form to another.

**Scrivnor, J. B.**

1. The use of the term "laterite": Geol. Mag., decade 5, v. 6, no. 12, p. 574–575, 1909.

This paper is a discussion of Mennell's statement in "Note on Rhodesian laterite" (*see* Mennell, F. P.) that laterite forms only in places having distinct wet and dry seasons. A deposit in the Federated Malay States near the town of Malacca hardens on exposure as defined by Buchanan. However, monthly rainfall figures for the town show that there are no distinct wet and dry seasons.

2. The use of the word "laterite": Geol. Mag., decade 5, v. 6, no. 9, p. 431–432, 1909.
3. The use of the term "laterite": Geol. Mag., decade 5, v. 7, no. 3, p. 139–140, 1910.
4. The term "laterite": Geol. Mag., decade 5, v. 7, no. 7, p. 335–336, 1910.
5. Laterite and bauxite: Geol. Mag., decade 5, v. 7, no. 8, p. 382–384, 1910.

These notes appear in the "Correspondence" section as a suggestion on nomenclature and in discussion of the matter with J. W. Evans and T. Crook.

**Seelye, F. T.**

(and Grange, L. I., and Davis, L. H.). The laterites of western Samoa: Soil Sci., v. 46, no. 1, p. 23–31, 1938.

Weathering of basalt flows of various ages ranging from Pleistocene to Recent has produced six named and described soil types in western Samoa. Chemical analyses show a loss of silica and alkalies in weathering. There is no segregation of iron and alumina into nodules. Most of the soils are only slightly acid to neutral, fairly fertile, and have a surprisingly high content of total nitrogen. The silica content is as low as 1 percent, alumina about 37 percent, iron 45 percent, and titania about 13 percent in one of the most leached types (Malatule).

**Seger, H.**

Zusammensetzung von Bauxit aus Ireland: Dinglers polytech. Jour., 224 Band, p. 334, 1880 [German].

**Seguiti, Tullio.**

Prove di arricchimento delle bauxiti istriane: Industria mineraria, anno 15, no. 1, p. 1–12, 8 figs. (incl. photomicrographs), Rome, 1941 [Italian].

Chemical analyses, X-ray analyses, and microscopic determinations have been made on bauxites from the Istrian Peninsula, Italy. The principal components are aluminum, iron, silicon, titanium, and water. Istrian bauxite is pisolitic and falls into two classifications—white and red. Because most of the bauxite is amorphous, the mineralogic composition was determined by X-rays. It was found, in general, that the white normally consists primarily of diaspore, while the red is of boehmite. The white bauxite tends to be higher in silica, and the red higher in iron. Reserves in Italy may amount to about 20 million tons. Of this about 9 million tons contains at least 56 percent alumina and less than 4 percent silica.

**Sena, J. da Costa**

Note sur l'hydrargillite des environs d'Ouro-Preto [Brazil]: Soc. Française minéralogie Bull., tome 7, p. 220–222, 1884 [French].

Chemical analyses of a sample of canga from near Ouro Preto, Brazil, showed it to be similar to that of hydrargillite, and the optical properties of the substance confirm this.

**Seymour, H. J.** *See* Cole, Grenville A. J.

**Sharasuvana, Sangar.** *See* Pendleton, Robert L.

**Sharma, N. L.**

Bauxite in India: Jour. Sci. Indus. Research, v. 1, no. 3, p. 212–224, sketch map, Delhi, 1943.

The paper presents a general survey of the occurrences of bauxite in India, its uses and production. Although there are many fairly high-grade and easily workable bauxite deposits in the country, production has been relatively insignificant.

**Shchukina, Ye. N. (Shukina, Tschukina).**

Boksity Yeniseyskogo kyrazha (The bauxites of the Yeniseyskiy range), *in* Boxity, tom 1, Mestorozhdeniya boksitov, priurochennyye k mezozoyskim otlozheniyam (Bauxites, v. 1—Bauxite deposits confined to the Mesozoic, pt. 2): Vses. nauch.-issledov. inst. mineral'nogo syr'ya Trudy, vyp. 111, p. 63–124, 225–227, 12 figs., Moscow-Leningrad, 1936 [Russian, English summary].

The area covered is the upper courses of some of the tributaries of the Angara—of the Tatarka, Bol'shaya Murozhnaya, Uderei, Rybnaya, Oslyanka, and Bol'shaya Penchenga.

An ancient widespread alluvium overlies pre-Cambrian, Cambrian, and intrusive rocks, but the process of formation did not cause the accumulation of aluminum and iron hydroxides. However, bauxite deposits occur in the Tatarsky and Rybinsky areas. These deposits occur in sink-holes on a karst surface. They vary in diameter from 50 by 100 meters to 250 by 350 meters; and in thickness from less than 3 to 20 meters. The bauxite is considered to have been taken into solution by carbonate and sulfate waters and deposited in the

central parts of shallow lake basins. At the same time clays and other sediments were deposited near the shore.

**Shearer, H. K.**

A report on the bauxite and fuller's earth of the Coastal Plain of Georgia: Ga. Geol. Survey Bull. 31, 340 p., 16 pls., 24 figs., 1 map, 1917.

Bauxite in the Coastal Plain of Georgia was first reported in Wilkinson County in 1909; mining began in 1910. The deposits in Sumter County were discovered in 1912, and mining began in 1914. These constitute two groups of deposits: (1) bauxite in Lower Cretaceous sediments in Wilkinson and adjacent counties; and (2) bauxite in formations of the Tertiary Midway group in Sumter County and southwestward to the State line. The deposits of both districts are described in detail. Thin sections and some heavy mineral analyses were made. Chemical analyses indicate that most of the alumina occurs as either gibbsite or kaolinite. It is suggested that the bauxite originated by the action of hydrogen sulfide on kaolin being deposited in lagoons. Mining methods, uses, and production of bauxite are discussed.

**Shelton, Richard C.** *See* Bryson, R. P.

**Shenck, A.**

Laterit und seine Entstehung: Deutsche geol. Gesell. Zeitschr., Band. 42, p. 610–611, 1890 [German].

The formation of laterite is discussed, and a classification suggested: (A) primary or eluvial laterite, and (B) secondary or detrital laterite.

**Shepherd, S. R. L.**

(and Connah, T. H.). Search for bauxite, southeast Queensland: Queensland Gov. Min. Jour., v. 48, no. 547, p. 156–169, 4 figs., Brisbane, 1947.

A reconnaissance survey for bauxite in southeast Queensland extended northward from Brisbane to Bundaberg, confined to areas known to be underlain by basalt. The deposits were found to lie about 70 miles inland in a narrow belt parallel to the coast and extending for about 200 miles from Maryvale, northward to the Binjour Plateau near Gayndah. Most of the bauxite was found on the tops of, or on the higher slopes of the ridges, but no deposits of importance were found on the lower slopes or valleys. During the investigation, 74 samples were collected and analyzed. Maps show the area studied.

**Sherman, G. Donald.**

Factors influencing the development of lateritic and laterite soils in the Hawaiian Islands: Pacific Sci., v. 3, no. 4, p. 307–314, 4 figs., 1949.

In the development of soils in the Hawaiian Islands, two processes take place: (1) the formation of kaolinitic clay minerals from the parent rock; and (2) decomposition of the clay minerals and the accumulation of the oxides of iron, aluminum, and titanium.

Soils developed in parts of the islands that have a definite wet and dry season—low humic latosols and ferruginous humic latosols—show the following characteristics: (a) in early stages of weathering, amounts of both kaolinite and alumina increase, later both decrease; (b) the silica content decreases with length of time of weathering; (c) iron and titanium oxide contents increase with weathering; and (d) the end product of such weathering is a "laterite crust" high in iron and titanium minerals.

Soils developed in parts of the islands having a continuously moist climate—

humic latosols and hydrol humic latosols—show the following characteristics: (a) rapid decomposition of the clay minerals to the free oxides; (b) increase in alumina content with increase in rainfall; decrease in iron and silica with increase in rainfall; and (d) the end product of weathering will be an "aluminum oxide laterite" or "bauxitic laterite."

**Shibuya, Kisaburo.**

The laterite soils of Formosa Island: Soil Sci., v. 13, no. 6, p. 425–431, June 1922.

In Formosa, although basalt, andesite, and sedimentary rocks all weather to red soils, those from Tertiary sandstones and shales are most widespread. The laterite is clayey and not very fertile. Chemical analyses of whole samples and the colloid fraction show silica to be present largely as quartz grains, and the aluminum and iron to be present as oxides, hydrates, and silicates. The iron content varies between 3 and 6 percent, but it is pointed out that the deep red color is due more to the degree of oxidation and uniform distribution of the iron than to an excessive quantity. Quartz, amorphous silica, hematite, magnetite, tourmaline, zircon, and other minerals were identified.

**Shiras, Tom.**

1. Largest bauxite mining operations in America are in Arkansas: Manufacturers Rec., v. 84, no. 14, p. 92–94, 3 figs., 1923.

A general description is given of open-pit mining methods and the proposed underground mining in the area. The town of Bauxite here described was built by the American Bauxite Company for its employees.

2. Underground mining of bauxite started in Arkansas: Eng. Min. Jour.-Press, v. 117, p. 497, 2 figs., 1924.

The American Bauxite Co., started underground mining at Bauxite, Ark. in 1924, in an effort to eliminate high cost due to stripping excessive thicknesses of overburden. It is planned to extend operations over 160 acres and at a depth of about 100 feet.

3. Bauxite mining in Arkansas: Eng. Min. Jour., v. 132, no. 10, p. 449–450, 2 figs., 1931.

The open-pit and underground mining methods used in Arkansas are described briefly.

**Shock, Lorenz.** *See* Gillin, J. A.

**Shtreis, N. A.** *See* Markova, N. G.

**Silva Pinto, Mario da.** *See* Pinto, Mario da Silva.

**Simmons, W. C.**

Laterization and peneplanation: p. 41, Uganda Geol. Survey Dept. Ann. Rept., 1928, Entebbe, 1929.

Much of Uganda, especially Buganda, is covered by a red soil which merges downward into a hard reddish-brown concretionary ironstone, called cellular laterite, murram, ironstone, or laterite. In Uganda a peneplain has been recognized, remnants of which can be seen in Central Buganda in the flat tops of hills. The laterite contains little free alumina.

**Simpson, E. S.**

Notes on laterite in Western Australia: Geol. Mag., decade V, v. 9, no. 9, p. 399–406, 1912.

Laterite in Western Australia is a hard capping that overlies weathered rock in areas such as the Darling Range peneplain, about 1,000 feet high, where there is little mechanical erosion. The laterite is considered to be an efflorescence resulting from normal weathering. The first stage is conversion of feldspars to kaolin and the solution of carbonates of iron, manganese, lime, and magnesia, together with hydrous silica, titania, and alumina in subsurface waters. During the dry season, these solutions rise by capillary action and, upon evaporaton, the salts and hydrates are precipitated at or near the surface. The alumina and silica are considered to be coprecipitated as colloidal halloysite. During the following rainy season the alkali salts and carbonates are redissolved and carried away into the streams. A classification has the following categories: (1) primary laterite consisting of a hard capping underlain by an almost pure pipe clay, which in turn rests on crystalline rock; and (2) secondary laterite, lateritite, a detrital primary laterite. The author suggests that laterite may be formed not only in areas having wet and dry seasons, but also in arid regions which have infrequent periods of intense rainfall.

**Singewald, Quentin D.**

Bauxite deposits at Gánt, Hungary: Econ. Geology, v. 33, no. 7, p. 730–736, 3 figs., 1938.

The bauxite deposits near Gánt, Hungary, consist of a remarkably continuous bed 15 to 30 meters in thickness. The bauxite, considered to be Cretaceous in age, nearly everywhere lies on an uneven surface of Triassic dolomites although locally it rests on the marine Jurassic. The deposits are overlain by Tertiary sediments, Cretaceous strata in a few places, or unconsolidated material.

**Sluys, M.**

Un gisement de latérite bauxitique pisoolitique sur le substratum granitique région de Niapu, Congo Belge): Soc. géol. Belgique Annales, tome 69, Bull. nos. 5–8, p. B 218–B 220, Liége, 1946 [French].

Niapu in the Belgian Congo lies on a plateau at the headwaters of the Ituri, Bima, and Rubi Rivers. The granite-gneiss basement has a cover of pisolitic bauxite low in iron. The bauxite is light colored; the pisolites, 2–4 centimeters in diameter, enclose oolites 1–4 millimeters in diameter. This material resembles the pisolitic laterite described by Lacroix in French Guinea.

**Smirnov, A. D.**

Mineralogicheskiy sostav mezozoyskikh boksitov Sredney Azii (Mineralogical composition of the Mesozoic bauxites in Middle Asia): Akad. nauk SSSR Izv., Ser. geol., no. 3, p. 114–126, 1 fig., 1 pl., Moscow, 1940 [Russian, English summary].

Two deposits of Jurassic age, one at Kshut and one at Mailisai, were found to consist largely of the monohydrate of alumina, thus differing from other Mesozoic bauxites in the U.S.S.R. wihch are made up largely of the trihydrate. Dynamometamorphism is suggested as the cause of the difference.

**Smirnov, L. N.**

O gidrogeologii Severoural'skikh boksitovykh mestorozhdeniy [On the hydrogeology of bauxite deposits in the Northern Urals]: Razvedka nedr, v. 13, no. 3, p. 52–54, Moscow, 1947 [Russian].

**Smirnov, S. S.**

Predistoriya Sovetskogo Alyuminiya; Yego Nastoyashchiye i Blizhayshiye Perspektivy (Past history of Soviet aluminum; its present condition and future prospects): Moscow, 1932 [Russian].

**Smith, Eugene A.**

(and McCalley, Henry). Index to the mineral resources of Alabama: Ala. Geol. Survey Bull. 9, 65 p., 6 pls., 1904.

A general résumé of bauxite deposits and mining in Alabama is found on pages 19 and 20.

**Smith, George Otis.**

(and Willis, Bailey). The Clealum iron ores, Washington: Am. Inst. Min. Eng. Trans., 1900, p. 356–366, 1 map, 1901.

The iron ores on the Clealum River, Wash., are described. In a discussion of the genesis of the deposits, it is indicated that they are aluminous, but that the percentage of alumina varies considerably. These ores are believed to resemble certain ferruginous bauxite deposits and to have a similar relation to the underlying rock as the German bauxites have to the underlying basalt.

**Smith, Richard W.**

Sedimentary kaolins of the Coastal Plain of Georgia: Ga. Geol. Survey Bull. 44, 482 p., 7 figs., 18 pls., 1929.

*Bauxite, p. 40–41 and 43–45.*—Bauxitic clays (40–52 percent $Al_2O_3$) may be pisolitic or may look like kaolin and are usually associated with deposits of bauxite (52–61 percent $Al_2O_3$). Bauxite in the Coastal Plain of Georgia is considered to have been derived from kaolin by the removal of silica. Bauxite deposits associated with kaolin lenses are described in detail in pages 410–459, in the section "Deposits of the Midway and Wilcox formations".

**Smolyaninov, N. A.** *See* Arkhangelsky, A. D.

**Soboleva, M. V.** *See also* Rozhkova, Ye. V.

1. Izucheniye dafnita Ivdel'skogo mestorozhdeniya na Severnom Urale (A study of the daphnite from the Ivdel deposit in the North Urals) *in* Boxity, tom 3 (Bauxites, v. 3): Vses. nauch.-issledov. inst. mineral'nogo syr'ya Trudy, vyp. 120, p. 24–28 and 68, Moscow-Leningrad, 1938 [Russian, English summary].

A mineral of the chlorite group was discovered in the bauxite of the Ivdel deposit. It occurs in the colloidal state and as crystals in veinlets and cavities. The flakes are a green color, with a refractive index of Ng, 1.672 and Nm, 1.658; they have a rather low birefringence characterized by bluish-grey tints. Chemical and X-ray analyses show this mineral to be daphnite.

2. Mineralogiya diaspor-shamozitovykh rud yuzhnogo Urals (The mineralogy of the diaspore-chamosite ores of the South Urals), *in* Boxity, tom 3 (Bauxites, v. 3): Vses. nauch.-issledov. inst. mineral'nogo syr'ya Trudy, vyp. 120, p. 35–47, 69–70, Moscow-Leningrad, 1938 [Russian, English summary].

In the Upper Devonian of the western slope of the Urals, bauxite deposits occur at two horizons, the Orlova and the Pashia. The bauxite of the Orlova series is characterized by minerals of the chlorite group, diaspore, and a colloid which may be a monohydrate of alumina. The ore is compact, oolitic, and com-

posed of "pea-shaped corpuscles". The matrix in the last two types is a colloidal and slightly gray-green gel. The oolites are largely a gel in which may be seen crystals of chlorite and diaspore. The oolitic ores range from those consisting largely of diaspore to those which have somewhat more chamosite than diaspore. The bauxites of the Pashia series are rarely oolitic. The ore characterized by "pea-shaped corpuscles" is largely diaspore with some chlorite. The presence of boehmite was indicated by X-ray analysis.

**Solov'yev, N. V. (Solov'ev, Soloviev).** *See also* Rozhkova, Ye. V.

K voprosu o deystvii uglekislykh vod na alyumosilikatnyye gornyye porody (On the problem of the action of carbonated waters on aluminosilicate rocks), *in* Boksity, tom 2—Mestorozhdeniya boksitov, priurochennyye k paleozoyskim otlozheniyam (Bauxites, v. 2—Bauxite deposits confined to the Paleozoic): Vses. nauch.-issledov. inst. mineral'nogo syr'ya Trudy, vyp. 112, p. 107–111, 1 fig., Moscow-Leningrad, 1936 [Russian, English summary].

Finely powdered specimens of South-Uralian granite, porphyrite, serpentine, and kaolin were covered with water saturated with $CO_2$ for a period of 18 months. Periodically, some of the water was drawn off and analyses were made of the amount of dissolved alumina and iron. Chemical analyses were also made of the powdered specimens both before and after the experiment. More alumina than iron was found to dissolve in the solution. It is considered that alumina is soluble enough to account for the formation of a number of aluminum ore deposits by precipitation from true or colloidal solutions.

**Solov'yev, V. G. (Solov'ev, Soloviev).**

[Pt. 1—] K metodike oprobovaniya i sortirovki boksitov Tikhvinskogo rayona [Towards methods of testing and sampling the bauxites of the Tikhvin region]; [pt. 2—] Proyekt instruktsii po razvedochno-eksploatatsionnomu oprobovaniyu boksitov tipa Podsosnenskogo mestorozhdeniya [Project of instructions on the testing of bauxites of the type of the Podsosnensk deposit in prospecting and exploitation]: Vses. geol.-razved. ob''yedineniya Trudy, vyp. 367, 58 p., 13 figs., 1934 [Russian, English summary].

As a result of the present study, it was shown that the bauxite deposits in the Tikhvin area were very uniform in thickness and composition in a horizontal direction. For this reason the number of drill holes, trenches, and chemical analyses usually used could be considerably reduced without sacrificing accuracy of information.

**Souza, Antônio J. A. de.**

A industria do aluminio no Brasil: Mineração e Metallurgia, v. 8, no. 47, p. 307–319, 2 figs., 1945 [Portuguese].

General information is given on the uses of aluminum, the amount of production compared to other metals, cost of metal production and of the installations, flow sheets, and description of the processes used in reducing bauxite to aluminum.

**Souza Santos, Tharcisio de.** *See* Maffei, F. J.

**Spangenberg, Kurt.**

1. (and Müller, Martha). Die lateritische Zersetzung des Peridotits bei der Bildung der Nickelerzlagerstätte von Frankenstein in Schlesien: Heidelberg. Beitr. Mineralogie u. Petrographie, Band 1, Heft 5–6, p. 560–572, 1949 [German].

2. Über das Vorkommen von Bauxiten und bauxitischen Tonen zwischen Siewierz und Tarnowitz (Oberschlesien): Neues Jahrbuch, Monatsh. Jahrg. 1949, Abt. A, Heft 7, p. 152–156, 1949 [German].

"Describes the field relations and the chemical and mineral composition of bauxites and bauxitic clays of possible usefulness as sources of aluminum found near Tarnowice, Śląsk, Poland".—†V. 25, no. 1, 1952.

**Speil, Sidney.**

Applications of thermal analysis to clays and aluminous minerals: U. S. Bur. Mines Rept. Inv. 3764, 36 p., 22 figs., 1944; U. S. Bur. Mines Tech. Paper 664, p. 1–37, 22 figs., 1945.

Thermal analyses of a large number of clays of the kaolinite and montmorillonite groups and of hydrous aluminum oxides have shown that (1) in bauxite ores, gibbsite is easily distinguished from diaspore or kaolinite; (2) peaks on the curves of montmorillonite samples may differ either in area or position; (3) a decrease in particle size of kaolin samples lowers the temperature at which decomposition occurs; (4) the peak of any mineral analyzed is displaced toward a lower temperature as the area of the peak is smaller, and (5) a difference in rate of temperature rise per minute affects the position and shape of the peak but does not change the area.

**Spencer, J. W.**

The Paleozoic group, the geology of ten counties of northwestern Georgia: 406 p., 10 pls., 34 figs., 1 map, Ga. Geol. Survey, 1893.

*Chapter 32, Beauxite.*—The bauxite occurs within deposits residual from the Knox dolomite and is considered to have been deposited contemporaneously with the dolomite. Location of deposits and chemical analyses are included.

**Stacey, R. H.** *See* Clemmer, J. B.

**Stache, G.**

Über die "Terra rossa" und ihr Verhältnis zum Karst-relief der Küstenlandes: Austria, K.-k. geol. Reichsanst. Verh., Jahrg. 1886, no. 2, p. 61–65, Vienna, 1886. [German].

The occurrence of red earth or terra rossa in the limestone areas of the Adriatic coast is considered to be due to deposition in depressions and pockets in a region of karst topography. The Coastal Province is considered to have been split into islands and an embayed mainland during the Quaternary period.

**Staesche, M.**

(and Wetzel, J.). Röntgenographische Untersuchungen über die thermischen Umwandlungen von Diaspor- und Böhmithaltige Bauxiten: Metall u. Erz, 41 Jahrg., Heft 9–10, p. 101–106, 12 figs., 1944 [German].

In X-ray analyses of a number of bauxite and kaolin samples, which had been heated to 105°, 300°, 450°, 500°, 600°, and 1150° C, the films showed changes of gibbsite to boehmite in samples which had been heated to 300°; boehmite to $\gamma$-alumina, in those which had been heated to 600°; and all three mineral types to $\alpha$-alumina, corundum, after they had been heated to 1150°. Many of the films and diagrams showing the position of the lines are figured.

**Stampfel, Ernest.** *See* Lapparent, Jacques de.

**Stearn, Noel H.**

A geomagnetic survey of the bauxite region in central Arkansas: Ark. Geol. Survey Bull. 5, 16 p., 4 figs., 4 maps, 1930.

A magnetometer survey was made over an area of about 1,100 square miles, with readings taken at 1,300 stations. A general area of high magnetic intensity was found to lie between Little Rock, Benton, Sheridan, and England, and within this area there are pronounced local anomalies.

**Stevart, A.**

Sur un nouveau minerai de aluminium (bauxite): Rev. univ. mines, tome 14, p. 387–388, 1863 [French].

This paper notes that a rock consisting essentially of ferruginous diaspore had been given the name "bauxite" by Henri Saint-Claire-Deville from the locality near Baux, France, where it was first discovered. The composition of bauxite is extremely variable. Of interest is the 1 to 2 percent of titania generally present. The most numerous deposits are found in the Departements of Var and Bouches-du-Rhône.

**Stewart, D. R.**

(and McManamy, L., and McQueen, H. S.). Occurrence of bauxitic clay in Stoddard County, Missouri: Mo. Geol. Survey and Water Res., 62d Bienn. Rept., App. 3, 21 p., 5 pls., 3 figs. (incl. geol. maps), 1943.

Bauxitic clay was discovered near Ardeola, Stoddard County, in 1940. This material lies at the Paleocene-Eocene contact and appears to be the result of alteration of the Porters Creek clay. When the area was uplifted and tilted southeastward, most of the altered mantle was removed by erosion. Many chemical analyses and a résumé of the stratigraphy of the region are included.

**Stillwell, F. L.**

Bauxite and clay from Mirboo North: Australia Council Sci. Indus. Res. Bull. 290, Melbourne, 1943.

**Stolyar, M. Ya. (Stoluar).**

(On further search after Paleozoic bauxites in the mountain ranges of the Kuznetsk basin): Akad. nauk SSSR, Izv., ser. geol., no. 6, p. 149–162, sketch map, Moscow, 1945. [Russian, English summary].

"Records bauxite and related types of deposits found in the Devonian limestones of the mountains bordering the Kuznetsk basin, U.S.S.R., and describes other Devonian limestone areas within the region in which bauxite may occur."—*V. 14, 1949.

**Stolyarova, T. I.** *See* B. P. Krotov.

**Streng, A.**

Über die Verwitterung der basaltischen Gesteine des Vogelsberges: Deutsche geol. Gesell. Zeitschr., Band 39, p. 621–622, 1887 [German].

The association of bauxite with basalt in the Vogelsberg region, Germany, is noted.

**Struthers, Joseph**

1. Aluminum and bauxite: U. S. Geol. Survey Min. Res. U. S., 1901, p. 225–229, 1902.

Statistics are given of domestic production of aluminum, 1883–1901; imports of aluminum, 1870–1901; world production by countries, 1900; and domestic bauxite production by States, 1889–1901.

2. Aluminum and alum: Mineral Industry, 1902, v. 11, p. 11–35, 1903.

The section on bauxite includes statistics of domestic production by States, imports, exports, and consumption from 1898 to 1902. The operating companies and a brief account of mining processes are briefly discussed by districts. World production is chiefly from France, Ireland, and the United States.

3. Aluminum and bauxite: U. S. Geol. Survey Min. Res. U. S., 1902, p. 231–238, 1904.

The expansion of the Pittsburg Reduction Company includes a new plant at Massena, N. Y. and plans for another on the St. Lawrence River. Data are given on production and consumption of bauxite and aluminum and on imports through 1902.

4. Aluminum and bauxite: U. S. Geol. Survey Min. Res. U. S., 1903, p. 265–279, 1904.

The aluminum-manufacturing companies in the United States and Europe are listed, giving location, horsepower, process used, and amount of capital. Statistics on domestic production and imports of aluminum and bauxite include 1903 and previous years. The mining companies and the areas in which they operated are discussed by States.

**Stull, Ray Thomas.**

1. Distribution of kaolin and bauxite of the Coastal Plain of Georgia: Am. Ceramic Soc. Jour., v. 7, no. 7, p. 513–522, 2 figs., 1924.

Sedimentary kaolin and bauxite in the Coastal Plain of Georgia occur in sediments of Lower Cretaceous age. Bauxite appears to have been derived from soft kaolin by decomposition and the removal of silica, possibly by laterization, and it occurs within larger lenses of kaolin. A classification of clays is proposed. The producing mines of 1924 are listed.

2. (and Bole, G. A.). Beneficiation and utilization of Georgia clays: U. S. Bur. Mines Bull. 252, 72 p., 23 figs., 1926.

*Bauxite, pages 6, 7, and 10.*—It is suggested that bauxite has formed from kaolin by the removal of silica and the alkalies, the process possibly being that of laterization. Bauxitic clays are defined as mixtures of bauxite and clay.

**Sylvany, R.**

Bauxite: Metal Industry, p. 403–407, 1916.

**Syromyatnikov, F. V. (Syromjatnikow, F. W., Suiromytnikov, F. V., or Syromyatnikov, F. B.).**

O mineral'nom sostave Ivdel'skogo boksita (Über die mineralogische Zusammensetzung des Bauxites von Ivdel): Moskov. obshch. ispytateley Prirody, Geol. otdel., tom 11 (4), p. 437–443, 3 figs., 1934 [Russian, German summary].

Chemical analyses and a petrographic study of bauxite from deposits near Ivdel, in the Ural Mountains, U.S.S.R., showed chamosite and diaspore to be the predominant minerals, with a little limonite and gibbsite.

**Szadeczky, Gyula.**

A Biharhegyseg aluminiumérczeiröl: Magyar földt. társulat Földt. közlöny,

kötet 35, füzet 5, p. 213–231, 1 fig. (small scale geol. map), 1905 [Hungarian].

The location of bauxite deposits in the Bihar Mountains [now Rumania], is given together with a description of the mineralogy and chemical analyses of representative samples. The tectonic history of the area is treated briefly.

**Szelényi, Tibor.**

Bauxitok berylliumtartalmának szinkepanalylikai meghatározása—Spectral-analytische Bestimmung des Berylliumgehaltes der Bauxite: Magyar tudományos akad., Mat. terészett. Ertesitő, Band 56, Teil 1, p. 231–248, 4 figs., Budapest, 1937 [Hugarian, German summary].

The methods and instruments used in a spectroscopic analysis to determine the beryllium content of bauxites is described. Some clay samples were analysed also, and comparison showed that there was in general little difference between bauxite and clay in beryllium content; in a few samples of the kaolin it was much lower, however, due to the manner of their formation. In 57 bauxite samples, the value ranged from 0.005 to 0.01 percent BeO, which is too low for commercial exploitation.

**Tait, Peter G.**

Australia: Eng. Min. Jour., v. 143, no. 2, p. 70–72, 1942.

This general paper on Australia contains only a brief paragraph on bauxite: "There have been no discoveries [of bauxite] of importance [since 1940], but new consideration is being given to the production of aluminum * * * extensive deposits of bauxite in New South Wales, Queensland, and Western Australia have been examined * * * and plans for the output of metallic aluminum * * * are well advanced."

**Takeuti, Tunehiko.**

1. Mineralogical studies of bauxite (1): Japanese Assoc. Mineralogists Jour., v. 27, no. 4, p. 171–192, 1942 [Japanese].

"Bauxites from various countries were studied by optical and X-ray methods. Bauxite from Haiphong, French Indo-China, is the only one which consists essentially of diaspore. Samples from Bintan Island, Dutch East Indies, Palau Island, Caroline Archipelago, and unknown localities of South America and Malay, are composed chiefly of gibbsite. Bauxite from Montpelier, France, is essentially boehmite. Greek bauxite is a mixture of diaspore and gibbsite. Yugoslavian and Indian varieties are boehmite and gibbsite. Refractive indices and X-ray powder photographs are given. Thermal properties of diaspore, boehmite, and gibbsite are tabulated."—*V. 12, 1947.

2. Mineralogical studies of bauxite (2); X-ray photographs of powdered bauxite: Japanese Assoc. Mineralogists Jour., v. 27, no. 5, p. 240–253, 1942 [Japanese].

"The distances of the X-ray diffraction lines were measured to determine the indices of the net planes, and the results tabulated. Diaspore, boehmite, and gibbsite were determined, the same minerals which were previously distinguished optically"—*V. 12, 1947.

**Teale, E. O.**

1. Final report with guide to specimens: 41 p., Tanganyika Geol. Survey, 1922.

*Bauxitic material from the Usambara Highlands, p. 12.*—Of three samples of bauxitic material analyzed, only the one from near Amani was of commercial quality. It contained 10.53 percent silica, 57.72 percent alumina, 1.15 percent

iron oxide, 1.66 percent titania, and 26.80 percent water. The other two samples contained 26–44 percent silica, most of which was considered to be present as quartz.

2. Provisional geologic map of Tanganyika with explanatory notes: Tanganyika Dept. Lands and Mines, Geol. Div. Bull. 6 (revised ed.), 50 p., 1 pl. (min. res. map), 1936.

*Bauxite, p. 42.*—"Bauxite * * * has been noted at Amani * * * Its occurrence is not of economic importance * * *." Most of the paper is a discussion of the geology of Tanganyika and of the important mineral resources.

3. (and Oates, F.). The mineral resources of Tanganyika Territory: Tanganyika Dept. Lands and Mines, Geol. Div. Bull. 16, 191 p., 4 pls. (incl. min. res. map), 1943.

*Aluminum-Ore* (*Bauxite*), *p. 50, 51.*—Bauxite has been noted at Amani. Bauxite clay occurs 2 miles west of Mombo overlying hornblende-pyroxene-granulite and garnet-biotite-pyroxene-gneiss. At both places the material consists of light-colored irregular concretionary nodules in a reddish somewhat lateritic soil.

4. (and Oates, F.). The mineral resources of Tanganyika Territory: Tanganyika Dept. Lands and Mines, Geol. Div. Bull. 16, Rev. ed., 192 p., 1946.

A brief statement on the location and description of bauxite deposits in the Territory is included in this comprehensive report on its mineral resources. The three chemical analyses presented show 10–43 percent silica. The size of the reserves is unknown.

**Teixeira, Emilio A.**

1. Bauxita no Planalto de Poços de Caldas, Estados de São Paulo e Minas Geraes: Mineração e Metallurgia, v. 1, no. 5, p. 205–214, 5 figs., 1937 [Portuguese, Engl. summary]; Brazil, Serviço Fomento Producção Min. Avulso, no. 15, 19 p., 5 figs., Rio de Janeiro, 1937 [Portuguese, English summary].

The Poços de Caldas mining district lies along the boundary between the States of São Paulo and Minas Gerais, about 400 kilometers from the harbor of Santos and about 320 kilometers from São Paulo. The Poços de Caldas Plateau is underlain by nepheline syenites which have been weathered to form bauxite. The ore occurs in situ, and as detrital deposits along small valleys. The principal deposits are described. Reserves of deposits examined are estimated to be 1,237,000 tons; the possibility of finding new deposits is excellent. Run-of-the-mine bauxite is 57–64 percent alumina, 2–11 percent iron oxide, 0.2–3.7 percent silica, and 29–31 percent water. Chemical analyses of the underlying igneous rocks are also included.

2. Brazil: Eng. Min. Jour., v. 143, no. 8, p. 89–93, 10 figs. (incl. maps), 1942.

In 1935, bauxite was discovered in the Poços de Caldos Plateau in the State of Minas Gerais along the railroad between Cascata and Poços de Caldas. The largest mine in the area has an estimated reserve of over 1 million tons. Total reserves for the plateau may be about 2 million tons of ore containing more than 58 percent alumina, and about 7½ million tons if some lower grade material is included. Other deposits in Brazil are in: (1) Muguy in Espírito Santo with an estimated reserve of a million tons; (2) Mutuca, with a reserve of 2 million tons; (3) the Gamba deposits near Ouro Preto and the Chapasao do Canga near Santa Rita Durao in Minas Gerais; and (4) Trauhyra Island in Maranhao. Total reserves for the country are estimated at about 20 million tons.

3. Notas sôbre a bauxita em Poços de Caldas: Mineração e Metallurgia, v. 6 no. 34, p. 159–163, 10 figs. (incl. sketch maps), 1942 [Portuguese].

The author revisited the area in 1941 and gives a further description of the bauxite deposits of the Poços de Caldas plateau, after the opening of mines to show cross sections. Such details as the following are described: the pebble or cobble bauxite lens in the bauxite and clay deposit of the Santa Rosália mine; the deposit of alluvial bauxite in the Antes Creek valley; the irregularity in thickness of the bauxite mantle; the sharp, nongradational contact between the bauxite and underlying nepheline rocks; the similar sharp contact between the inner fresh rock or boulders lying in the residuum and their outer crusts. New branch-line railways, hydraulic plants, and washing and beneficiation plants are discussed. Reserves of various kinds of bauxitic material amount to more than 5 million tons.

**Teleki, Géza.**

A Zagorje-Fensík bauxitja—Der Bauxit vom Zagorje-Hochland, Dalmatien: Magyar kir. földt. intézet Évkönyve, 35 kötet, 1 füzet, p. 1–34, 22 figs., 1 pl. (geol. map), 1940 [Hungarian, German summary]; abs., Zeitschr. prakt. Geol., 51 Jahrg., Heft 8, p. 95, 1943 [German].

The Zagorje highland of the Dalmatan region, Yugoslavia, is characterized by a karst topography, little vegetation, and a gravel-covered surface. The underlying rocks in the area are Cretaceous limestones which are Senonian, Turonian, and Rudistid equivalents. The Tertiary is represented by many formations: in the lower Eocene, by the Liburnian, *Cosina*, and *Alveolina* limestones; in the middle Eocene, by Nummulitic and other limestones; in the upper Eocene, marls and limestones; in the lower Oligocene, by *Promina* conglomerate, marls, and flysch; and in the Pliocene, by terra rossa, loams, and talus. These Cretaceous and Tertiary rocks are folded into a series of more or less parallel anticlines and synclines of the Dineric system. Folding occurred several times but the most pronounced was during Miocene time, with isoclinal folding and thrust faulting. The bauxite deposits, as lenses or pockets in the limestones, occur structurally at the tops or sides of anticlines or along fault planes. The stratigraphic position of the deposits appears variable, having a footwall of the Rudistid, Alveolina, or Nummulitic limestone and a hanging wall of Cosina, Alveolina, or Nummulitic limestone, Promina conglomerate, or later formations. The origin of the deposits is not considered known for certain except that they must have formed during periods of emersion and may be related to Miocene volcanic activity.

**Terent'yeva (Terenteva), K. F.**

(and Il'ina (Ilyina, Iljina. N. S.). (On the monohydrate alumina mineral in Silurian and Devonian limestones from the district of the "Krasnaya Shapochka" deposit): Akad. nauk SSSR Izv., ser. geol. no. 4, p. 23–24, Moscow, 1942 [Russian, English summary].

Diaspore and boehmite have been identified in the limestones overlying and those underlying the Krasnaya Shapochka bauxite deposit in the Urals, thus indicating that such material was being transported into the basin for a much longer period of time than that represented by the bauxite deposit itself.

**Terrill, S. E.**

Notes on laterite in the Darling Range near Perth, Western Australia: Roy. Soc. Western Australia, Jour. v. 34, 1947–1948, p. 105–114, 2 pls., Perth, 1950.

Detailed microscopic studies of laterite and the underlying parent quartz-dolerite showed that the plagioclase feldspar is replaced by microcrystalline

material which is mainly gibbsite, and that much of the laterite retains the texture of the parent rock. Chemical analyses show about 70 percent of the alumina to be present as one of the hydrated oxides. Thin sections show that the alumina to ferric oxide ratio is almost the same in the quartz-dolerite as in the laterite. The laterite is considered to have formed from the quartz-dolerite by the removal of "constituents not in the laterite" (quartz and alkalies) in solution by percolating meteoric waters.

**Thiel, George A.**

The enrichment of bauxite deposits through the activity of microorganisms: Econ. Geology, v. 22, no. 5, p. 480–493, 2 figs., 1927.

Two experiments were conducted using shale, kaolins, and crushed microcline, which were leached with stock solutions—one sterile, the other inoculated with a culture solution of active, sulfate-reducing bacteria and filtered carbonaceous material. In the 7 samples used, chemical analyses of the drippings of those treated with bacteria showed the percent of alumina to range from almost twice to almost 7 times that of silica. However, the analysis of the sterile solutions ranged from a little less silica than alumina to about 5¼ times more silica than alumina. Transportation and precipitation of alumina by similar solutions are suggested to account for the enrichment of bauxite deposits. A greater amount of alumina was taken into solution by the breakdown of the kaolinites than of the shale or microcline.

**Thoenen, John R.**

1. (and Burchard, Ernest F.) Bauxite resources of the United States: U. S. Bur. Mines Rept. Inv. 3598, 42 p., 1 pl., 1941.

Bauxite is known [1941] to occur in Alabama, Arkansas, Georgia, Mississippi, and Tennessee; reported occurrences elsewhere are not considered to have economic significance as of date of the report. Reserves for the United States are estimated to be: Grade A (more than 55 percent $Al_2O_3$), 9,343,000 tons; Grade B (50–55 percent $Al_2O_3$), 8,898,000 tons; Grade C (45–50 percent $Al_2O_3$), 8,439,000 tons; and Grade D (30–45 percent $Al_2O_3$), 2,348,000 tons. Uses, mining methods, mining companies, production, and related matters are discussed briefly. This paper gives a comprehensive picture of the bauxite industry during the beginning of World War II, and its probable future, in terms of reserves of high and low grade ore, mining practices, and industrial consumption.

2. (and Malamphy, Mark C., and Dale, George K.). Application of the ternary diagram to analysis and classification of bauxite reserves [abs.]: Econ. Geology, v. 40, no. 1, p. 95, 1945.

By use of the ternary diagram it is shown to be possible to check chemical analyses quickly and to determine the principal mineral constituents at a glance. The apexes of the triangle are gibbsite, kaolinite, and impurities.

3. (and Malamphy, Mark C., and Vallely, James L.). Geophysical survey of Arkansas bauxite region: U. S. Bur. Mines Rept. Inv. 3791, 49 p., 14 pls. (incl. geol. maps), 1945.

Magnetic and gravimetric surveys over an area of approximately 1,400 square miles in the bauxite district in Arkansas indicated the presence of 10 previously unknown syenite domes, later proved by drilling. Only two of these domes projected above the buried Midway-Wilcox contact—a condition requisite for the formation of bauxite. The geophysical data also indicated the configuration of the buried flanks of the known syenite outcrops. Magnetic surveys along the Midway-Wilcox contact between Gurdon and Searcy showed the improbability of the existence of other syenite masses similar to those in the bauxite district.

**Thompson, Raymond M.** *See also* Warren, Walter G.

1. Kaolin deposits of Washington County, Ga., *text on* Geologic map of the principal clay area of Washington County, Ga.; U. S. Geol. Survey Strategic Minerals Inv. Prelim. Map, scale 1:60,000, Feb. 18, 1944.
2. Kaolin deposits of Twiggs County, Ga., *text on* Geologic map of the principal clay area of Twiggs County, Ga.: U. S. Geol. Survey Strategic Minerals Inv. Prelim. Map, scale 1:60,000, Feb. 18, 1944.

In each of these preliminary publications, the geology of the area and the lithology of the mapped units are briefly described. Location of clay mines and outcrops are shown on the map. No bauxite deposits are known in either county, although some kaolin deposits contain small amounts of gibbsite.

**Tietze, Oskar.** *See* Dammer, Bruno.

**Tomkeieff, S. I.**

Clay minerals and bauxite minerals, a review and classification based on a statistical method: Mineralog. Mag., v. 23, no. 143, p. 463–482, 7 figs., 1934.

A detailed study was made of the chemical composition and mineralogy of the clay minerals and the aluminum and iron hydrates. Numerous analyses plotted on a triangular grid diagram show no indication of isomorphism between the mono- and trihydrates of aluminum, although solid solution between $H_2O.Fe_2O_3$ and $Fe_2O_3$ is possible. Although only two aluminum hydrates were indicated by the study, several polymorphous forms and isomers of each are listed.

**Toulmin, Lyman D., Jr.**

The Midway-Wilcox contact in Alabama: Ala. Acad. Sci. Jour., v. 16, p. 41–42, 1944.

Bauxite and limonite deposits occur near the contact between formations of the Midway and Wilcox groups, and a study of these formations was made to facilitate the search for new deposits. A fossiliferous greensand marl recently discovered in the thick series of unfossiliferous beds at the contact has been placed in the Midway and the contact between the Midway and Wilcox placed just above this formation.

**Tracey, Joshua I., Jr.** *See* Goldman, Marcus I.; Gordon, Mackenzie, Jr.; *and* Malamphy, Mark C.

**Trewartha, Glenn Thomas.**

Japan, a physical, cultural, and regional geography: 607 p., 281 figs. (incl. maps), Madison, Univ. Wisconsin Press, 1945.

The main sources of bauxite within the Japanese Empire were: (1) Palau and the Mandated Islands, and (2) an undisclosed source in northern Korea on the upper course of the Yalu River. Additional ore was imported from Malaya and the Netherlands East Indies (Indonesia). The discussion of bauxite forms a very minor part of the book.

**Trought, Mary E.** *See* Davis, Hubert W.; Franke, Herbert A.; Harris, Florence E.; *and* Weitz, John H.

**Tućan, Fran.**

1. Terra rossa, deren Natur und Entstehen: Neues Jahrbuch, Beil.-Band 34, Heft 2, p. 401–430, 1912 [German].

Chemical analyses of terra rossa from Zlobin, Plase, Grobničko polje, Karlobag in the Dalmatian coastal area, and from Jelenje, Eminovoselo, and Obrovac in other parts of Yugoslavia are given together with lists of the accessory minerals in each locality. Terra rossa and bauxite are considered to be identical except that bauxite is an ancient terra rossa. Sporogelite, the monohydrate of aluminum and the main constituent of terra rossa, is also found in marine clayey limestones and is considered to have been laid down simultaneously with the limestone.

2. Wieder zu Tucan's Bauxitfrage: Centralbl. Mineralogie, 1913, p. 768–769, 1913 [German].

A list of minerals found in limestone and dolomite in Croatia, Yugoslavia, is presented in relation to the bauxite question. This paper also is part of the controversy on nomenclature.

3. Zur Bauxitfrage: Centralbl. Mineralogie, 1913, p. 65–68, 387, 1913 [German].
4. Bauxit in Neuem Licht; Centralbl. Mineralogie, 1913, p. 495–497, 1913 [German].

These papers are a part of a controversy over the question of whether bauxite is a mineral or a rock consisting of several minerals in varying proportions. *See also* Lazarević, 1913.

5. Zur Kenntnis des Mehligen Siliciumdioxides von Milna auf der Insel Brač in Dalmatien, mit Besonderer Berucksichtigung der Bauxitfrage: Centralbl. Mineralogie, 1913, p. 668–675, 3 figs., 1913 [German].

A study was made of a sample of silica from Milna. Discussion of the use of the terms bauxite and sporogelit is continued, and the author replies to criticism by Lazarević in the same journal.

6. Beitrag zur Mineralischen und Chemischen Kenntnis der Bauxite aus Lika: Acad. Yougoslave Sci. Bull. internat, livre 28, p. 5–18, 5 pls., Zagreb, 1934 [German].

This paper is a résumé of the one next cited (see Tućan 7), in which the mineralogy and chemical analyses of the bauxites at Lika, Yugoslavia, are discussed in detail.

7. Prilog mineralnome i kemijskome poznavanju ličkih boksita: Jugoslavenska akad. znanosti i umjetnosti Radi, knjiga 249, p. 46–79, 5 pls., Zagreb, 1934 [Croatian].

The mineralogy and chemistry of the bauxite deposits at Lika, Yugoslavia, are described in detail.

**Tumanov, S. G.**

(and Ryasanov, V. D., and others). Zhuravlinskoye mestorozhdeniye boksita (The Jourawlinskee bauxit-deposit): Inst. prikladnoy mineralogii i metalurgii Trudy, vyp. 19, p. 1–97, 15 figs., 5 pls., 2 maps, Moscow 1926 [Russian, English summary].

Bauxite occurs at the crest of an anticline in Lower Carboniferous rocks in the Jourawlinskee [Zhuravlinsk] district, U. S. S. R. The bauxite attains a thickness of 0.75 meter and grades laterally into kaolin. Reserves are estimated to be about 46,000 tons, of which about half is bauxite, and about half is alunite and kaolinite.

**Tyler, Paul M.**

Mechanical preparation of nonmetallic minerals: Am. Inst. Min. Metall. Eng. Trans., v. 112, Milling Methods, p. 785–823, 1934.

*Bauxite, p. 793.*—Bauxite in which silica occurs as clay can be run through a log washer to remove silica. The clean ore is crushed to 1½ or 2 inches to be calcined or dead-burned.

**United States Geological Survey.**

World atlas of commercial geology; pt. 1, Distribution of mineral production: 72 p., 72 pls., U. S. Geol. Survey, 1921.

*Aluminum, p. 66, pls. 57–64.*—The geographic and geologic distribution of the bauxite deposits of the world, the nature of the ore, and political and commercial control of the deposits are very briefly mentioned. A map of the world and one of each continent show the approximate location of areas where bauxite was produced on a commercial scale. The relative production is shown by symbols.

**Utescher, Kurt.**

Käolinische und tonig-lateritische Gneiszverwitterung im Habelschwerdter Gebirge (Grafschaft Glatz): Reichsamt. f. Bodenforschung Jahrbuch 1941, Band 62, p. 191–206, 1941 [German].

In the Habelschwerdt Mountains an unusual weathering profile overlies a gneiss. The area studied lies north of the Kaiserwald, between Erlitz and Kressenbach, Germany. Chemical and mechanical analyses of samples through the profile at four localities indicate that two weathering products were formed. The more recent weathering, under humid conditions, produced a clay-laterite soil; no bauxite was formed. The older weathering, during the Tertiary, showed distinct formation of kaolin. Kaolin in this profile constitutes 20–24 percent of the soil samples.

**Vadász, Elemér.**

1. Kohlenbildung, Gebirgsbildung und Bauxitbildung in Ungarn: Neues Jahrbuch, Beil.-Band 65, Abt. B, p. 291–304, 1 pl., 1931 [German].

The relationship between the formation of coal and bauxite beds and orogenic movements is discussed. Orogeny, in causing a movement of the strand line, will affect the type of deposition in any one place. Bauxite occurs as the terrigenous equivalent of barren marine sediments and also of coal-bearing beds only slightly down the dip.

2. Bauxitvorkommen in Griechenland: Zeitschr. prakt. Geologie, 41 Jahrg., Heft 6, p. 97–102, 3 figs., 1933 [German].

A general discussion of the geology and bauxite deposits of Greece is presented. Chemical analyses of 10 samples are included; a typical analysis shows 59.90 percent $Al_2O_3$, 2.38 percent $SiO_2$, 21.00 percent $Fe_2O_3$, 2.70 percent $TiO_2$, and 14.00 percent $H_2O$.

A general estimate of the bauxite resources of Greece is 1½ to 2 million tons.

3. Bemerkungen, zu den Bauxitvorkommen der Insel Amorgos: Zentralbl. Mineralogie, 1934, Abt. A, p. 182–185, 1 fig., 1934 [German].

The geology and bauxite deposits of Amorgos Island, Greece, are briefly described. Analyses of 10 samples are included, of which the first is typical: 58.34 percent $Al_2O_3$, 4.22 percent $SiO_2$, 22.50 percent $Fe_2O_3$, 2.80 percent $TiO_2$, and 11.94 percent $H_2O$. The only horizon at which the bauxite is considered to occur in the island is the upper part of the Lower Cretaceous; but, because of the complex faulting, this is not easily apparent.

4. Das geologische Alter der Transdanubischen Bauxitbildung: Zentralbl. Mineralogie, 1934, Abt. B, p. 429–443, 1 fig., 1934 [German].

The relationship of the bauxite deposits of the Transdanubian area, Hungary, to the stratigraphy and structure of the area is described. Analyses of two samples of typical oolitic bauxite show approximately 43 and 54 percent alumina, 8 and 6 percent silica, 31 and 26 percent iron oxide, and 11 and 12 percent water, respectively. These analyses indicate the presence of the monohydrate of alumina. The bauxite occurs in steeply dipping beds, which, although thin, extend a considerable distance along the strike.

5. A Magyar bauxitelöfordulások földtani alkata—Die geologische Entwicklung und das Alter der ungarischen Bauxitevorkommen: Magyar allami föltani intézet Evkönyve, kötet 37, füzet 2, p. 174–286, 23 figs., 1946 [Hungarian and German].

The geologic occurrence and the character of the bauxite in the following districts in Hungary are described: Gánt, Bihar, Nagyharsany, Perepuszta, Sümeg vidéke, Iszkasventgyörgy-Fehervárcsurgó, Magyaralmás, Halimba, Nagynémetegyháza-Ujbarok, Nézsa, and Altalános eredménvek. The texture, formation, and chemical composition indicate that the Hungarian bauxite was derived from silicate rocks by weathering. The age of the deposits at Bihar, Nordbakony. and Nagyharsany is Lower Cretaceous; others are older than the Eocene or lie between Eocene and Upper Cretaceous sedimentary rocks.

**Vageler, P.**

Physikalische und chemische Vorgänge bei der Bodenbildung in der Tropen: Fühlings landw. Zeitung, Band 59, p. 873–880, 1910 [German].

Laterite is defined as a weathering product which consists largely of aluminum hydroxide, and iron oxide and hydroxide, and from which silicic acid, quartz, and the alkalies have been removed. The primary and secondary, or high- and low-level, laterites of others are recognized, but the term is not extended to cover other materials commonly called laterite. The author advances a theory for the formation of laterite in which bacterial activity and the formation and effects of sulfuric acid are important. A tropical climate is considered to be essential, because of the characteristic high temperature and the consequent breakdown of organic substances that prevents an acid reaction in the soil. Laterite does not form in an acid environment. The bauxite deposits in the Vogelsberg, Germany, as laterites derived from basalts, indicate a tropical climate in the area during its formation in the Tertiary period.

**Vallely, James L.** *See* Malamphy, Mark C.; *and* Thoenen, John R.

**Vardanianz, L. A.**

O mestonakhozhdenii boksita v okrestnostyakh Yashkinskogo tsementnogo zavoda (The bauxite occurrence in the vicinity of the cement plant Jaschkinsk: Western Sibiria, Zapadno-sibir. geol.-razved. tresta Vestnik, no. 3, p. 9–12, Tomsk 1931 [Russian].

**Vardabasso, Silvio.**

Nota sulle bauxiti istriane: Accad. sci. veneto-trentino-istriana Atti, v. 11, p. 3–7, 1920 [Italian].

Bauxite in the Istrian peninsula occurs in limestones of Upper Cretaceous age and is overlain by detritus. The author consideres the bauxite to be the result of chemical alteration in a period of general land emergence between Cretaceous and Eocene time.

**Vasil'yevskiy, M. M. (Vasil'evskii, Vassiliewsky, Vasilievskij).**

1. O boksitakh Tikhvinskogo uyezda Novgorodskoy gubernii (Sur les boxites du district Tikhvin du gouvernment Novgorod): U. S. S. R., Geol. kom. Izv., 1918, tom 37, no. 5–6, p. 511–520, Petrograd 1920 [Russian, only title in French].
2. Materialy po issledovaniyu tikhvinskikh boksitov (Matériaux relatifs à l'étude des bauxites de Tikhvin): U. S. S. R., Geol. kom. Izv. 1926, tom 45, no. 10, p. 1083–1131, 23 figs., 2 pls., Leningrad 1927 [Russian, French summary].

Bauxite was first discovered in the Tikhvin district in 1916 by P. Timofeev. Eight areas in the Krasnyi Routchei region were explored, and bauxite was found in all but three. The results include much data on the change in chemical composition throughout the deposits. This is shown in part on graphs and briefly mentioned in the summary. The geology of the area is somewhat complicated and obscured because of glacial cover, but the bauxite deposits appear to overlie limestones of Lower Carboniferous age.

**Veatch, J. Otto.**

1. A new discovery of bauxite in Georgia: Eng. Min. Jour., v. 85, p. 688, 1908.

The newly discovered bauxite deposit [1908] lies 3 miles east of McIntyre in Wilkinson County, Georgia. It occurs geologically in the Tuscaloosa formation in the Coastal Plain and is overlain by sands and clays of Eocene age. The deposit is a blanket type which in one place is 10 feet thick. The mineral is pisolitic, and cream to bright red in color. Chemical analyses are included.

2. The bauxite of Wilkinson County, Georgia. Ga. Geol. Survey, Bull. 18, Appendix D, p. 430–447, 3 figs., 1909.

The bauxite deposits in central Georgia are not related to those in the Appalachian region, but occur near the northern margin of the Coastal Plain. The bauxite, always contiguous to white clay beds, lies directly on the Tuscaloosa clays of Cretaceous age and is overlain by the Claiborne sands and clays of middle Eocene age. The bauxite is largely pisolitic, but some is amorphous. It is suggested that these deposits originated from the chemical alteration in place of pure white clay. The outcrops of bauxite in the county are described in detail.

**Velikovskaya, Ye. M.**

1. Boksity Severo-Vostochnogo Kazakhstana (The bauxites of the northeastern part of Kazakhstan), *in* Boksity, tom 1—Mestorozhdeniya boksitov, priurochennyye k mezozoyskim otlozheniyam (Bauxites, v. 1, Bauxite deposits confined to the Mesozoic, pt. 2): Vses. nauch.-issledov. inst. mineral'nogo syr'ya Trudy, vyp. 111, p. 3–62 and 223–224, 12 figs., Moscow-Leningrad, 1936 [Russian, English summary].

In the northeastern part of Kazakhstan, a weathering crust covers nearly all the Paleozoic rocks, both sedimentary and igneous. It is characterized by bright, variegated colors and is nonplastic. The weathering process tended to produce kaolin. The boundary between this crust and the overlying bauxite deposits is sharp, with a zone containing fragments of Palezoic rock occurring at the contact in some places. Within a radius of 200 miles of Akmolinsk, 12 deposits were discovered. They occur in red, argillaceous-arenaceous, continental sediments of Jurassic age. The bauxite, surrounded by yellow or red clay, generally lies at the periphery of pre-Jurassic troughs and appears to be in blocks or in "continuous fractured beds," 1–6 meters thick. These deposits nearly everywhere have the pisolitic texture of the hard ferruginous type. The chemical composition varies between 30 and 65 percent alumina, and 1.5 and 12 percent silica; usually, however, it contains about 35–45 percent alumina, 2–4 percent

silica, and 7–30 percent ferric oxide. A mineralogic study showed gibbsite, but silica and iron were in the gel state. It is suggested that the bauxite was precipitated from solution in lakes less than 2 meters deep.

2. Boksity vostochnoy chasti Turgayskoy vpadiny, Basseyn r. Ashu-Tasty-Turgay (Bauxites of the Turgai depression): Vses. nauch.-issledov. inst. mineral'nogo syr'ya Trudy, vyp. 151, p. 3–44, 21 figs., 3 pls. (geol. maps), Moscow-Leningrad, 1939. [Russian, English summary].

A number of bauxite deposits were discovered along the Ashu-Tasty-Turgai River in the eastern part of the Turgai depression in Central Kazakhstan. Multicolored clay beds and bauxite deposits were laid down on the eroded Paleozoic and Carboniferous surface. By the end of the Mesozoic, most of these sediments had been eroded. In depressions on this eroded surface, Tertiary and Quaternary clays and sands were deposited. The bauxite deposits therefore are now found at the tops of small rises or hills and are somewhat resistant to erosion. The most widespread is the light-colored pisolitic bauxite, but both white and dark red types are present and represent end members of a series. The gibbsite content varies from 45 to 89 percent; iron occurs as limonite and hematite; titanium, as rutile and a colloid; silica, as a clay or a gel. The bauxite is considered to have formed in small lakes.

**Venkataramiah, B. N.**

Notes on prospecting for bauxite in the Kadur and Chitaldurg districts: Mysore Dept. Mines and Geology Rec., v. 17, 1918, pt. 2, p. 124–133, 1920.

The results of field work in 1917 on the bauxite deposits of the Kemmangundi area and on the low hills in the Chitaldurg district are presented. Chemical analysis of samples from the first named showed about 29–42 percent alumina, 28–40 percent iron oxide, and 1–4 percent silica. Those from the second district, overlying schists, showed about 33–37 percent alumina, 3–20 percent iron oxide, and 32–44 percent silica.

**Vestal, Franklin Earl.**

Bauxite, tripoli, and fuller's earth in northeastern Mississippi [abs.]: Ala. Acad. Sci. Jour., v. 7, p. 34, 1935.

The bauxite deposits of Mississippi occur in the basal part of the Wilcox formation and are widely scattered in a hilly area. Total reserves may amount to 2½–3 millions tons or more of all grades, but nearly all of it is of low grade. Tripoli and fuller's earth are also briefly discussed.

**Vialay, A.**

Essai sur la genése et l'evolution des roches: 2$^{e}$ ed. [with supplement], 226 p., Paris, H. Dunod et E. Pinat, 1912 [French].

This is a general text on the chemical and mineralogic evolution of rocks and contains a short section on the formation of bauxite by the alteration of pre-existing rocks.

**Villa, Alberto Echeverri**

Colombia, systematic survey needed to determine mineral resources and stimulate search for metal other than gold: Eng. Min. Jour., v. 143, no. 8, p. 109–111, 6 figs., 1942.

Bauxite is reported to occur near Santa Rosa de Osos, Antioquia. Nodules of bauxite have been found in the vicinity of Copacabana, Antioquia, and in the Departamento de Tolima. The paper is largely a discussion of the important mineral resources of the country.

**Vinogradov, A. P.**

(and Boichenko, Ye. A.). Decomposition of kaolin by diatoms: Akad. nauk. SSSR Doklady, v. 37, no. 4, p. 135–138, 1942 [English].

The silica valves in diatoms may be derived from water soluble silica or extracted from clays. In the experiments described, sterilized diatoms and mixtures of diatoms and bacteria were tested to determine which material was effective in decomposing the clay. It was shown that: (1) diatoms destroy kaolin (nacrite), with the liberation of aluminum hydrate by the effect of their pectinous substances, and cause an exfoliation and destruction of the nacrite crystals; (2) bacteria (*Azotobacter chroococcum*), in mixed cultures with diatoms and also alone, did not decompose kaolin.

**Vishnyakov, S. G. (Vishniakov, S. Q.).**

1. Geologicheskiye rezul'taty po glubokomu bureniyu v Tikhvinskom boksitonosnom rayone (Geological results of deep boring in the Tikhvin bauxite-bearing region): Leningrad. geol.-gid.-geodez. tresta Izv., no. 4–5, p. 18–34, 2 figs., 2 pls., 1934 [Russian, English summary].

A series of 15 holes was drilled in the northern part of the Moscow Basin in order to study the stratigraphy and to determine whether the Tikhvin bauxite deposits to the east extended into the area. Bauxite was found in nearly all holes but does not exceed 1 meter in thickness.

2. Predvaritel'nyye resul'taty litologicheskogo issledovaniya v Tikhvinskom boksitonosnom rayone (Preliminary results of a lithological survey in the Tikhvin bauxite district [Russia]): Leningrad. geol.-gid.-geodez. tresta Izv., nos. 2–3 (7–8), p. 64–69, 1935 [Russian, English summary].

Preliminary lithologic studies in the Tikhvin bauxite district show: (1) that the areno-argillaceous series may be divided into three parts—a continental, a coastal and deltaic, and an estuarine-marine series; and (2) that the most favorable localities for the occurrence of bauxite are northeast of the central part of the Tikhvin district.

**Vogt, G.**

Der Bauxite und seine Gewinnung: Die Stein-Industrie, Band 23, p. 54, 1928; abs., Neues Jahrbuch, Referate II, Heft 4, p. 385, 1929 [German].

The areas of Europe where bauxite is mined [1929] are named.

**Voit, F. W.**

Die Eisenerzlateritlagerstätten des Donderbary und der Möglichkeit einer Hochofen- bzw. Eisenindustrie in Surinam (Niederländisch-Guyana): Zeitschr. prakt. Geologie, 30 Jahrg., Heft 2, p. 17–24, 1922 [German].

The author describes the iron-rich laterites of Surinam and the stratigraphy and geologic history of the area.

**Volkov, A. N.**

1. (and Langvagen, V. V., and others). O lateritnom vyvetrivanii nekotorykh verkhne-devonskikh porod v Tikhvinskom rayone (Laterite weathering of certain upper Devonian rocks in the Tikhvin region): Vses. geol.-razved. ob''yedineniya Trudy, vyp. 351, 68 p., 15 figs., 1934 [Russian, English summary].

The Upper Devonian rocks in the Tikhvin region consist of sericite, green mica, weathered feldspar, and rarely quartz. The particle size is greater than that of clays but so fine as to be called a fine earth. These sediments are overlain

by sands of the same composition, except that in these quartz is dominant. Lower Carboniferous sands overlie the Devonian with an erosional unconformity along which are found deposits of bauxite. These appear to be the result of lateritic weathering in situ. The bauxite grades downward into the areno-argillaceous series of Devonian age, but there is a sharp contact with the overlying Carboniferous rocks. A petrographic study of the greenish-gray clay under the bauxite showed a gradation into variegated spotted clay in which mica, rutile, zircon, and tourmaline can be recognized. Somewhat higher in the section, the rock is spotted and streaked and is largely a fine, disperse mass under the microscope. Still higher, the rock is hard, rarely oolitic, somewhat porous, and minute plates of gibbsite can be recognized. Studies of the chemical composition showed a gradual decrease in silica from bottom to top.

2. (and Dvorshchan, Ye. I.). Alyuminiyevye rudy (Aluminum ores): U. S. S. R., Tsentral'niye nauch.-issledov. geol.-razved. inst. Trudy, Mineral'no-syr'yevaya baza SSSR no. 21, 45 p., 1935 [Russian, with table captions in English].

**Volkova, M. C.**

Nekotoryye dannyye o boksitakh i lateritakh Bat-Bakkarinskogo i Yesil'skogo rayonov KASSR (Some data on the bauxites and laterites of the Bat-Bakkarinsk and Essilsky regions, C. A. S. S. R.): Problemy Sovetskoy geologii, tom 1, no. 3, p. 230–240, Moscow, 1933 [Russian, English summary].

Laterite and bauxite deposits were found in Kazakhstan (latitude 50° to 51° 48′ N. and longitude 66° to 67° E.) in Tertiary beds of probable Oligocene age. The bauxite occurs as lenses of variable grade. One analyzed sample contained 58 percent $Al_2O_3$ and 3.5 percent $SiO_2$.

**Volosyuk, G. K.**

Totinskoye mestorozhdeniye boksitov [The Tota river deposit of bauxites]: Razvedka Nedr no. 1, p. 17–20, 2 figs., Moscow 1937 [Russian].

"Describes the bauxite deposits of the Tota river district, north Urals region, Russia."—*V. 7, 1939.

**Waagen, Lukas.**

Die Bauxitlagerstätten in Oesterreich und den sogenannten Nachfolgestaaten und deren praktische Verwertbarkeit: Zeitschr. prakt. Geologie, 44 Jahrg., Heft 9, p. 133–143, 1936 [German].

The distribution and economic value of the bauxite deposits of Austria and Yugoslavia are discussed. The deposits are of Tertiary age and fill sink holes and other irregularities in a karst topography developed on the Triassic limestones. Representative chemical analyses, many of them from other published sources, are included for comparison between areas. To be considered of good quality, bauxite may contain 53.2–60.8 percent alumina, 1.40–1.52 percent silica, 1.15–3.0 percent titania, and 20–25 percent iron oxides.

**Wadia, D. N.**

Aluminum ore and bauxite deposits of Jammu Province, Kashmir State: Jour. Sci. Indus. Research, v. 5, no. 5, ser. B., p. 65–67, Delhi, 1946.

Large deposits of bauxite occur in the Riasi district, Jammu Province, and somewhat smaller ones in the Thakiala area, Punch State, Kashmir. They are extensive, blanketlike deposits overlying the basal Eocene limestone only where it is exposed at the surface. The mineralogy of the ore is unknown, but the

chemical composition of high-grade ore is intermediate between that of diaspore and bauxite, or 80–82 percent alumina and less than 4 percent silica; the iron content is uniformly low. Reserves of highest grade ore in the Riasi district are estimated to be 2 million tons. Reserves of ore containing 65–75 percent alumina and 6–15 percent silica amount to 10 million tons. The reserves in Punch State are unknown. Difficulties have been encountered in using this material in the Bayer process because it is insoluble in caustic soda at ordinary temperatures.

**Waksman, Selman A.**

Principles of soil microbiology: 2d ed., 894 p., 83 figs., Baltimore, Md., The Williams and Wilkins Co., 1932.

This book is a treatise on the decomposition of rocks and minerals by bacteria, and the effect of rainfall, temperature, insolation, and other factors. Many experiments performed by the author and by other workers in the field are referred to. The major parts of the book are entitled: (A) The soil population. Occurrence and abundance of microorganisms in the soil. (B) Isolation, identification, and cultivation of soil microorganisms. (C) Chemical activities of microorganisms. (D) Soil microbiological processes and soil fertility.

**Walters, Barnett K.**

The Greek bauxite mining industry: U. S. Dept. Commerce World Trade, v. 8, pt. 23, no. 15, 2 p., June 1950.

The only Greek bauxite deposits that have been worked are in the central part of the country. The bauxite is high in diaspore. Mining operations are discussed by areas. Production and exports of Greece are shown on tables.

**Walther, J.**

Laterit in Westaustralien: Deutsche geol. Gesell. Zeitschr., Monatsber., Band 67, p. 113–132, 1 fig., 1915 [German].

The large-scale weathering of all types of rocks along the coast and near-coast areas of the western part of West Australia are described.

**Wang, C. C.**

The bauxite deposits of Poshan and Tzechuan districts, Shantung: China Geol. Survey Bull. 18, p. 23–37, 2 figs., 4 pls. (incl. geol. map, 1:100,000), 1932 [English].

A bauxite-bearing shale was discovered in the Poshan and Tzechuan coal field area in Shantung, China. The stratigraphy and structure of the area as a whole is treated briefly. Reserves are very large; in the vicinity of Heishan they are estimated to be about 8½ million tons; northward from Poshan, about 15 million tons; between Poshan and the Tahuangti coal mine, 236 million tons; at Hungshan, about 12 million tons; estimates were not made for other areas. The total reserve is estimated to be 271 million tons. The bauxite is red in exposed outcrops, but is greenish gray on fresh surfaces. Mineralogic studies showed the bauxite to be largely amorphous, but some acicular crystals were seen which were probably gibbsite. A typical chemical analysis is 52 percent alumina, 5 percent ferric oxide, 29 percent insolubles, and 14 percent loss on ignition. The origin of the deposits is discussed briefly.

**Warren, Walter C.**

1. Bauxite deposits of Barbour and Henry Counties, Ala.: U. S. Geol. Survey Strategic Minerals Inv. Prelim. Map, scale 1:42,500, Jan. 16, 1943.

A geologic map of parts of Barbour and Henry Counties, Ala., shows location

of bauxite mines, outcrops, and areas favorable for prospecting. No text accompanies the map.

2. (and Thompson, Raymond N.). Bauxite and kaolin deposits of Wilkinson County, Ga.; text and three maps appear on two printed sheets together with a mineographed list of mines: U. S. Geol. Survey Strategic Minerals Inv. Prelim. Map, scale 1:60,000, Nov. 29, 1943.

A brief text includes a discussion of the stratigraphic position of the deposits, types of bauxite, grade, and reserves. The stratigraphic units are also described. A geologic map of the county appears on sheet 1; sheet 2 includes bauxite prospecting maps of two small areas, one along Big Sandy Creek, and the other along Commissioner Creek in Wilkinson County.

**Warth, F. J.** *See* Warth, H.

**Warth, H.**

1. Über Hydrargillite von den Palni-Bergen im Suden Indiens: Centralbl. Mineralogie, 1902, p. 176–179, 1902 [German].

*See* Warth, 3.

2. (and Warth, F. J.). The composition of Indian laterite: Geol. Mag., decade 4, v. 10, no. 4, p. 154–159, 1903.

Twenty-three analyses of laterite are given. One group, called "wocheinite", is high in titania, and shows a mixture of gibbsite and diaspore [mononydrate]. The high-level laterites show a variation in iron content related to the underlying basalt. The low-level, or detrital laterites, show free silica as quartz and clay. This paper is important in being the first to show that much of the widespread laterite of India is largely aluminum hydrate.

3. On gibbsite from the Palni Hills in southern India: Mineralog. Mag. and Jour. Mineralog. Soc., v. 13, p. 172–173, London, 1903.

The mineral described occurs in the Palni Hills, in the Madura district, Madras Presidency. It overlies the gray igneous rock of the "charnockite series" as a bed of loose material about a foot thick and extending over several acres. "The mineral is amorphous and takes the form of nodular plates up to half an inch in thickness . . . The specific gravity is 2.42 and the color nearly white with a cream or reddish tint." Chemical analysis showed a composition close to that of pure gibbsite. This appears to be the first recorded occurrence of gibbsite in India.

**Watanabe, Kyukichi.**

A note on the occurrence of a bauxitic shale in Shan-Tung, China: Japanese Jour. Geology and Geography, v. 3, no. 3–4, p. 87–90, 1924 [English].

In the coal fields of Po-shan, Tzu-chan, and Chang-chiu in Shan-tung, China, a bauxitic shale crops out over an area about 100 kilometers long. Stratigraphically the shale lies near the top of the Po-shan coal bed series of Permian and Carboniferous age. Absence of an unconformity above the shale suggests that it was formed in a manner similar to Fermor's "lake laterite". Chemical analyses indicate a low-grade bauxite. The material is hard, compact, and fissile but frequently breaks with a conchoidal fracture and may have a pisolitic or oolitic texture. It is amorphous under the microscope.

**Watanabe, Manjiro.**

Pumiceous aluminum ore from Kurosawajiri, Iwate Prefecture [Japan]: Japanese Assoc. Mineralogists, Petrologists, and Econ. Geologists Jour., v. 31, no. 4, p. 168–176, 1944 [Japanese, English title].

**Watkins, Joel H.**

1. Bauxite near Elizabethtown, Tennessee: Eng. Min. Jour., v. 95, p. 604–605, 2 figs., 1913.

In 1912 a bauxite mine was opened about 4 miles north of Elizabethtown and about 1 mile northwest of Keenburg by the National Bauxite Co. The ore body is in a large, irregularly-shaped pocket in the Knox dolomite and contains small amounts of decomposed chert, kaolin, and halloysite. The ore is pisolitic, and analyzes 18.38 percent insolubles, 4.13 percent iron oxide, 49.9 percent alumina, and 27.59 percent water. Both the geological horizon and the structure are almost identical with those in the Georgia-Alabama district, although about 200 miles north of it.

2. Occurrence of bauxite in central Georgia: Min. World, v. 42, p. 1073–1075, 3 figs., 1915.

The bauxite deposits of central Georgia occur at the top of Cretaceous clays and are overlain by Tertiary sands. The bauxite is pisolitic in most places but is also massive and may contain much iron as well as free silica in the form of sand. Mining is by open-pit stripping. Occasionally some blasting is required, but usually the ore is dug out with pick and shovel. In 1915 only the Republic Mining and Manufacturing Co. was operating in the area.

**Watson, J. C.** *See* Whitelaw, O. A. L.

**Watson, Thomas Leonard.**

1. The Georgia bauxite deposits, their chemical constituents and genesis: Am. Geologist, v. 28, no. 1, p. 25–45, 1 fig., 1901.

Bauxite deposits of the Coosa Valley in Appalachian Alabama and Georgia have been mined since 1888. The deposits are closely related to fault zones and occur in rocks ranging in age from the Weisner quartzite of Cambrian age to the Knox dolomite of Silurian age. However, because of their relation to an old erosion surface, the deposits are probably of Eocene age. Chemical analysis indicates that the alumina is present as the trihydrate. The origin of the deposits is discussed and the work of others is reviewed. The age of the deposits is considered to be probably near the close of the Eocene epoch.

2. A preliminary report on the bauxite deposits of Georgia: Ga. Geol. Survey Bull. 11, 169 p., 12 pls., 3 figs., 1 map, 1904.

The known deposits of bauxite in Georgia, [1904] occur in 6 counties in the northwestern part of the State and are described in detail by districts. Many chemical analyses were made and indicate that alumina in the ore occurs as the trihydrate with clay as an impurity. The origin and age of the deposits are discussed.

**Wayland, E. J.**

Annual report of the Geological Department for the year ending 31st March 1920: 88 p., Entebbe, Uganda Protectorate, 1921.

*Aluminum, p. 54.*—Bauxite is reported to occur in both the Northern and the Eastern Provinces and in Buganda, Uganda Protectorate. The extent of the deposits or the grade of the ore are not known.

**Wedding, —.**

Notiz über den Beauxit: Niederrhein. Gesell. Natur- u. Heilkunde, Sitzungsber., Band 8; abs., Neues Jahrbuch, Jahrg. 1863, p. 723, Bonn [German].

This notice of the new mineral "beauxite" mentions the location of the original

samples found in the vicinity of Beaux, near Avignon, France, and that it consists largely of alumina and iron oxide plus water, clay, titania, and some vanadium.

**Weigelin, M.**

Beitrag zur Kenntnis des dalmatinischen Bauxits: Zeitschr. prakt. Geologie, 38 Jahrg., Heft 8, p. 123–126, 4 figs., 1930 [German].

The bauxite deposits of Dalmatia, Yugoslavia, occur at two horizons. The lower rests on the late Cretaceous Rudistid limestone and is overlain by the *Cosina* limestone beds; the upper deposits occur between the Tertiary *Promina* conglomerate and the *Alveolina* or Nummulitic limestone. The Tertiary bauxite is the more important commercially. The deposits were folded and faulted during the Dinaric orogeny in the Tertiary. The bauxite beds are considered to have been laid down as marine deposits composed predominantly of more or less colloidal aluminum hydroxide in suspension. This was derived from the neighboring mainland where lateritic weathering was going on.

**Weisse, Jean-Godefroy de.**

Les bauxites de l'Europe centrale (Province dinarique et Hongrie): Soc. vaud. sci. naturelles Mém., no. 58, v. 9, no. 1, 162 p., 14 figs. 2 pls. (incl. geol. map), Lausanne, 1948 [French].

The bauxite deposits of central Europe are described in detail, and the author draws the following conclusions:

1) Following the terminology of Fox, two types of bauxite are differentiated—terra rossa, which overlies limestone, and lateritic bauxite, which is the result of the alteration of crystalline rock—both of which are grouped by Harrassowitz under the name of allite.

2) The allites of central Europe are almost exclusively of the terra rossa type.

3) The wall rock of most of the deposits in the Dinaric Province is limestone; but in the trans-Danubian deposits, it is dolomitic limestone.

4) The two characteristics always present in any deposit are the irregularity of the foot wall or enclosing rock and the flat and even surface of the roof, or overlying rock.

5) The absence of fossils and detritus and the irregularity of the wall, which indicates a karst surface, points to a continental origin of the bauxite.

6) Bauxite occurs at three stratigraphic horizons in the Dinaric province—the Upper Triassic, Upper Cretaceous, and middle Eocene—and in the trans-Danubian, at two horizons—the Lower Cretaceous, and the Upper Cretaceous.

7) Terra rossa younger in age than the Lutetian is not known in Europe.

8) The continental deposits formed on limestone in Neogene and Quaternary time are alluvial deposits of old terra rossa.

9) The difference between terra rossa and bauxite lies in the fact that the former contains more silica.

10) Bauxite is formed from terra rossa by the removal of silica.

11) The factors important in the change are the pH of solutions and the climate.

12) The effect of the climate is still largely unknown, but probably the most favorable is a tropical or subtropical climate with alternating wet and dry seasons.

13) The change in climate in Europe since Neogene time explains the absence of bauxite of Recent age.

14) The three types of bauxite in central Europe are those composed of gibbsite (hydrargillite), boehmite, and diaspore.

15) Bauxite consisting largely of gibbsite appears to represent the form of alumina that is stable under atmospheric pressure; boehmite, under slightly higher pressure; and diaspore, under still higher temperatures and pressures.

**Weitz, John H.** *See also* Bridge, Josiah.

1. (and Trought, M. E.). Bauxite and aluminum: U. S. Bur. Mines Minerals Yearbook, 1942, p. 685–712, 2 figs., 1943.

Statistics on domestic and world production and consumption include the current and previous years. A section on foreign bauxite and aluminum industries shows production figures, operating companies, types and locations of installations, areas mined, some chemical analyses, or information on grade of ore. Domestic mining companies are listed, with the areas in which they operated. A section is devoted to a discussion of technologic developments. Production of bauxite and aluminum are shown on graphs. During the year, 8 government-owned reduction plants were begun or completed; the Olin Corp. became a third aluminum producer; and two government-owned alumina plants were built. Domestic production of bauxite increased 176 percent over that in 1941. Mines in Arkansas produced 94 percent of the total; the remainder came from Alabama, Georgia, and Virginia. Consumption by industries shows 79 percent used in the manufacture of aluminum.

2. The light metals: Eng. Min. Jour., v. 144, no. 2, p. 69–70, 1943.

The alumina plants in operation and under construction, and tonnages of bauxite and alumina needed to meet a goal of one million short tons of metal are discussed. Steps taken by the government to avoid wasting reserves included classification of bauxite for industry as high- and low-silica restricted ore and non-restricted ore. Restricted ore is allotted by industries.

3. (and Trought, M. E.) Bauxite and aluminum: U. S. Bur. Mines Minerals Yearbook, 1943, p. 683–712, 2 figs., 1945.

Statistics on domestic and world production and consumption include the current and previous years. A section on foreign bauxite and aluminum industries shows production figures, operating companies, types and locations of installations, areas mined, some chemical analyses, or information on grade of ore. A section is devoted to a discussion of technologic developments. Production of bauxite and aluminum are shown on graphs. Domestic production increased 144 percent over that in 1942; imports increased 75 percent in the same period. Largest production was from Arkansas, with 97 percent, followed by Alabama, Georgia, and Virginia. Consumption by the aluminum industry increased over the previous year and took 89 percent of all domestic and imported ore used. Other large users are the abrasive, refractory, and chemical industries.

4. (and Trought, M. E.). Bauxite and aluminum: U. S. Bur. Mines Minerals Yearbook, 1944, p. 666–696, 2 figs., 1946.

Statistics on domestic and world production and consumption include the current and previous years. The following subjects are discussed: the production and uses of domestic and imported bauxite; foreign bauxite and aluminum industries showing production figures, operating companies, types and locations of installations, areas mined, some chemical analyses, or information on grade of ore; mining companies and the areas in which they operated; and technologic developments. Data on size of deposits, new developments, or names of mining companies are included. Domestic production dropped 54 percent during 1944 following cancellation and termination of many contracts for low-grade bauxite with the Metals Reserve Company. In Arkansas, 22 companies were operating at the beginning of the year, and only 6 at the end. Arkansas produced 96 percent of the ore mined in 1944, followed by Alabama and Georgia. No mining was done in Virginia.

5. (and Trought, M. E.). Bauxite: U. S. Bur. Mines Minerals Yearbook, 1945, p. 674–687, 1 fig., 1947.

Statistics on domestic and world production and consumption include the current and previous years. Subjects discussed are: the production and uses of domestic and imported bauxite; mining companies and the areas in which they operated; and bauxite mining in foreign countries. Data on size of deposits, new developments, or names of mining companies are included. Domestic production dropped 65 percent from 1944 and was the lowest since 1941. Imports increased 32 percent during the same period. Seven companies in Arkansas produced 93 percent of the 1945 domestic total; two companies mined in Alabama, two in Georgia, and one in Virginia. One company investigated the low-grade deposits in Oregon.

**Werenskiöld, W.**

Bauxitforekomster i Provence: Norsk geol. tidsskr., Bind 4, Hefte 3, Og 4, p. 256–257, 1 fig., Kristiana, 1918 [Norwegian].

Bauxite deposits of Provence, France, are described briefly.

**Wetherell, E. W.**

Laterite of Mysore: Mysore Geol. Dept. Mem., v. 3, pt. 1, 27 p., 1 pl., no date [prior to Aug. 1906].

The first part of the paper is a discussion of the nature and origin of high- and low-level laterites and lithomarge. The Bangalore-Kolar laterite is considered to have been deposited in an ancient lake, the bed of which was gneiss and granite, but from which the laterite was not derived. In the area of the postulated lake, every flat-topped hill has a laterite cover, and all are of about the same altitude. The age of the laterite is suggested as Tertiary or older.

**Wetzel, J.** *See* Staesche, M.

**White, Walter S.**

Geology of the Warm Springs bauxite district, Georgia: U. S. Geol. Survey Strategic Minerals Inv. Prelim. Map, scale 1:2,400, May 15, 1943.

Text and map with eight cross sections, on two photostat sheets. The geology and the bauxite deposits of the area west of Warm Springs, Meriweather County, Ga., are briefly described. The two types of bauxite—red and white—occur in veins. Chemical analyses, reserves, and suggestions for further prospecting are included. The geologic structure of the area is shown in the cross sections.

**Whitelaw, O. A. L.**

(and Watson, J. C.). Bauxite clays at Narracan South: Victoria, Geol. Survey Rec., v. 4, pt. 3, p. 277–279, 2 figs., 1921.

Bauxite clay, discovered in allotment 8 in the parish of Narracan South, Victoria, Australia, is a flat-lying bed about 15 feet thick which is separated from the underlying Jurassic sandstones and shales by a thin bed of sand and gravel. The bauxitic clay is overlain by volcanic clay and red soils. Chemical analysis of a typical sample shows 55.40 percent alumina, 2.69 percent iron oxide, and 14.84 percent silica.

**Whitlatch, George I.**

1. Bauxite: Tenn. Dept. Conserv., Div. Geology Markets Circ. 2, 9 p., 1937.

Bauxite was first discovered in Tennessee on Missionary Ridge, East Chattanooga, in 1906. Bauxite deposits and mines in Tennessee in Carter, Hamilton, and Stewart Counties are described. Short sections on prices, uses, production, and commercial grades are included.

2. The ceramic resources of Tennessee: Am. Ceramic Soc. Bull., v. 17, no. 7, p. 289–291, 1938.

Bauxite of grade suitable for abrasives has been mined near Chattanooga and in Carter County.

3. Preliminary directory of mineral and chemical industries in Tennessee Tenn. Dept. Conserv., Div. Geol. Markets Circ. no. 11, 31 p., 1941.

In 1939 the Alcoa plant produced 41 percent of the primary aluminum manufactured in the United States. No Tennessee bauxite was used in the plant.

**Wilkinson, S. B.** *See* Cole, Grenville A. J.

**Wilkinson, W. D.**

(and Lowry, W. D., and Baldwin, E. M.). Geology of the St. Helens Quadrangle, Oregon: Oreg. Dept. Geology Mineral Industries Bull. 31, 39p., 2 pls., 5 figs. (incl. geol. maps), 1946.

*Bauxite, p. 22–23, 36.*—Ferruginous bauxite or laterite formed on the Miocene basalt series by a long period of laterization which took place before the deposition of the overlying silty beds. Chemical analyses of channel samples average 38 percent alumina, 21 percent iron oxide, 5 percent titania, and 9 percent silica.

**Williams, C. H.**

Practical notes on the mining of iron ores, bauxite, etc. of County Antrim [Ireland]: Manchester Geol. Soc. Trans., v. 22, 3 figs., p. 518–521, 1892–94.

The ore is mined by driving in levels and making side drifts from them. Where the roof is not sound, pillars are left, otherwise the ore is worked out on the longwall system. Bauxite is underlain by lithomarge, as is the iron ore, and is overlain by basalt or by lignite.

**Williams, J. Francis.**

The igneous rocks of Arkansas: Ark. Geol. Survey Ann. Rept., 1890, v. 2, 457 p., 22 pls., 44 figs., 6 maps, 1891.

All of the igneous rocks of Arkansas are shown to be varieties of "eleolite" syenite and associated dikes; all are deep-seated intrusives. The larger masses of rock occur near the main anticlinal axis of the Ouachita uplift near the central part of the State and were probably intruded in late Cretaceous time. These syenites are described in detail for the four main intrusive regions: Fourche Mountain, or Pulaski County; Saline County; Magnet Cove; and Potash Sulphur Springs. Bauxite is briefly mentioned as genetically related to the syenite and overlying it as well as occurring interbedded in Tertiary deposits.

**Williams, W. B.**

Bauxite in Tasmania: Imp. Inst. Bull., v. 41, no. 3, p. 196–200, London, 1943.

Deposits of ferruginous bauxite were discovered in Tasmania in the Ouse, Campbell Town, Swansea, and St. Leonards districts. Of these, only the first has been extensively investigated. There the bauxite occurs as a lenticular crust varying in thickness to a maximum of 19 feet. The overburden is less than 3 feet thick in most places. The reserves for the district are estimated to be more than 2 million tons of bauxite, which may contain 41.2 percent alumina, 3.2 percent free silica, and 2.17 percent titania, and unknown percentages of iron and water. The other districts are described briefly.

**Willis, Bailey.** *See* Smith, George Otis.

**Wilson, George Victor.**

1. The Ayrshire bauxitic clay: Geol. Mag., v. 57, p. 139–140, 1920.

Chemical analyses showed that the bauxitic clay from Ayrshire, Scotland, was high in alumina (26–52 percent), but most of it occurs combined with silica, as kaolin. The clay overlies basalt of the Millstone Grit series from which it was derived by weathering.

2. The Ayrshire bauxitic clay: Geol. Survey of Scotland, Mem., 28 p., 1922.

Bauxitic clay occurs in Ayrshire, Scotland, overlying decomposed basaltic flows which form part of the Millstone Grit series (Carboniferous). It is considered that, following the volcanic activity, the area was a land surface for a considerable time, during which lateritic weathering occurred. Two types of bauxitic material are recognized: (1) bauxitic clay formed in place by the downward percolation of water; and (2) bauxitic clay formed as a true sedimentary deposit on the floors of shallow lagoons. The main part of this clay seam can be traced about 15 miles from South Bay, Saltcoats eastward to Fenwick water; smaller lenses and outcrops can also be seen. No reserve estimates were possible.

The color of the ore is gray to yellow, brown, or black. The texture is compact to oolitic, or even pisolitic; it is hard and breaks with a conchoidal fracture. Chemical analyses show a great variation: 26–60 percent alumina, 29–60 percent silica, 4–14 percent titania, 5–10 percent iron oxide, and 7–15 percent water. Chemical studies indicate that the matrix may be nearly all kaolinite, and that the oolites may be about half kaolinite and half diaspore. However, no diaspore was seen under the microscope. The bauxite is used for refractory brick.

**Woblack, Anne.** *See* Hutchinson, G. Evelyn.

**Woolnough, W. G.**

1. Physiographic significance of laterite in Western Australia: Geol. Mag., decade 6, v. 5, no. 9, p. 385–393, 2 figs., 1918.

Laterite in Western Australia is considered as having formed from the underlying crystalline rocks by the leaching of soluble salts and their precipitation at the surface during the dry season by capillary action, thus forming a hard capping on the kaolinitic weathered rock. Laterite in the Darling Range, a plateau 900 to 1,700 feet high, is believed to have formed under peneplain, not plateau, conditions. In areas with a gentle stream gradient and insignificant amounts of mechanical transportation, chemical weathering would be favored. High-level laterite is, therefore, taken as an indication of subsequent uplift of the land surface; likewise, differences in elevation of laterite here suggest later faulting. A classification is suggested: (1) plateau (high-level) laterite; (2) detrital (low-level) laterite; and (3) river terrace laterites. Variations in the types of laterite eastward from Perth are noted and the reasons for the changes discussed.

2. Origin of white clays and bauxite, and chemical criteria of peneplanation: Econ. Geology, v. 23, no. 8, p. 887–894, 1928.

An essential criterion of peneplanation is the very deep and complete chemical weathering of the underlying rocks. A uniformly moist climate during the last stages of peneplanation is postulated if the residual material consists of only the most insoluble products of weathering. However, definitely wet and dry seasons during the last stages are indicated by a crust of concretionary or amorphous material, chiefly alumina, iron oxide, or amorphous silica resting on a substratum of insoluble residual constituents, such as that found in Western Australia. Clays formed in regions that are continuously moist, such as those of South Carolina, are white, not because of selective deposition from a red soil regolith, but because in such regions the iron has been removed in solution.

**Worcester, W. G.**

Ceramics and industrial minerals: Canadian Min. Metall. Bull. 403, p. 617–622, 1945.

The uses of bauxite, diaspore, and other minerals in ceramics and refractory products are mentioned.

**Wright, Charles Will.**

United States turns to South America for many critical minerals: Mining and Metallurgy, v. 23, no. 432, p. 590–593, 3 figs., 1942.

Much of the United States supply of critical minerals comes from South America. The most important are mica, quartz crystals, industrial diamonds, bauxite, baddeleyite, beryl, tantalite, monazite, rutile, and asbestos.

**Wysor, D. C.**

1. Aluminum hydrates in the Arkansas bauxite deposits: Econ. Geology, v. 11, no. 1, p. 42–50, 1916.

Chemical analyses were made of bauxite, especially of oolites (pisolites) in order to determine which aluminum hydrates were present. The monohydrate, here called diaspore, was found only in the oolites. Gibbsite occurred in all types of ore; the mono- and dihydrate are said to be derived from it. The author recognized the mono- and trihydrate as end members of a series with most analyses representing mixtures of the two, but some of the intermediate members were interpreted as containing a rather high percentage of the dihydrate, bauxite. It was also noted that oolites which have a hardness greater than 4 have an average specific gravity of 2.7+; those less than 4, 2.4+; the specific gravity of the matrixes averaged about 2.3+.

2. Aluminum hydrates (discussion): Econ. Geology, v. 12, p. 282–285, 1917.

In reply to L. L. Fermor's criticism (see Fermor, 4) of his paper in volume 11 (see Wysor, 1), the author points out: (1) the method of obtaining the percent alumina by difference was checked by the method of direct weighing; (2) chemical analysis of mineral grains showed $TiO_2$ to be present largely as ilmenite; (3) there is little reason for calling the clay associated with Arkansas bauxite "lithomarge" to conform with usage elsewhere; (4) careful chemical analysis of secondary gibbsite gave a composition close to the theoretical composition of pure gibbsite, but the slightly higher water content suggested the presence of a higher hydrate also; (5) restricting the terms gibbsite and diaspore to crystalline material only is considered impractical; and abolishing the mineral term bauxite is considered premature until the dihydrate is proved to be unknown in nature.

**Yagovkin, A. A.**

[The Zhuravlinsk bauxite deposit]: Molotov gosudar. univ. Uchenyye zapiski, Yubeleynyy (Material for studying the Kama Priural'ye region, Perm. Mus.), vyp. 1, p. 3–5, 1928 [Russian].

"The rocks of the Zhuravlinsk deposit are qualified by the author as bauxites, but the content of $Al_2O_3$ averages only about 30 percent, that of $SiO_2$ extends to about 25 to 30 percent, that of $Fe_2O_3$ to about 25 percent. The lateritic rocks or, to use the term introduced by Prof. Harrassowitz, allitic siallites are worthless and no method of manufacturing $Al_2O_3$ including the electrothermal one invented by Mr. Haglund, can raise their value as far as manufacturing pure $Al_2O_3$ is concerned."—*A. N. Z.*, †V. 1, 1929.

**Zamfirescu, Elisa Leonida.**

Contributiuni la studiul bauxitelor din Romănia: Inst. geol. Romăniei; Studii tech. si econ., v. 13, facs. 10, 43 p., 3 pls., 2 maps, 1931 [Romanian]; abs. Geol. Zentralbl., Band 49, nr. 3, p. 138, 1933.

The bauxite deposits in the Bihar Mountains, Rumania, occur on an irregular surface between limestones of Jurassic and lower Cretaceous age. Reserves for this area are estimated to be a minimum of 20,710,000 tons. There are about 8 important localities. The bauxite is gray or is red or brown with a compact texture. Diaspore is the predominant aluminum hydroxide, but there are also minor amounts of hydrargillite. The paper includes a great many chemical analyses.

**Zapp, Alfred D.**

General features of the Andersonville bauxite district; *text on* Andersonville bauxite district, Georgia: U. S. Geol. Survey Strategic Minerals Inv. Prelim. Map, scale 1:40,000, April 23, 1943.

The geologic map covers parts of Macon, Schley, and Sumter Counties, Ga., and includes contour lines showing altitudes below which bauxite is not likely to be found. The geology of the area and the position and description of the bauxite deposits are given briefly in the text.

**Anonymous.**

1. Bauxite: Mineral Industry, 1892, v. 1, p. 41–42, 1893.

The history of the discovery of bauxite and its geographic and geologic location are given. Data on imports, 1873–92, and domestic production of bauxite, 1892, are included, and also the names of producing mines and operating companies.

2. Bauxite: Mineral Industry, 1894, v. 3, p. 83–84, 1895.

The paper includes a brief history of the discovery of bauxite deposits in the United States; statistics on production in Alabama and Georgia, 1890–94; and imports and consumption for the same period.

3. Bauxite: Mineral Industry, 1897, v. 6, p. 58–59, 1898.

Domestic production by States, imports, and consumption of bauxite, 1893–97, are given. Operating companies are listed. Small quantities of bauxite were exported in 1897 for the first time. A recent innovation in the industry is the installation of washing and drying plants.

4. Aluminum and alum: Mineral Industry, 1898, v. 7, p. 20–30, 1899.

A section on bauxite gives the domestic production by States, imports, exports, and consumption, 1894–98. Preparation of bauxite for the market, market conditions, the export trade and bauxite in foreign countries are all discussed briefly.

5. Aluminum and Alum: Mineral Industry, 1899, v. 8, p. 11–33, 1900.

The section on bauxite includes figures on domestic production by States, imports, exports, and consumption, 1895–99. The Arkansas district, a new producing area, produced 3,050 tons in 1899; names of operating companies in the district are listed.

6. Aluminum and alum: Mineral Industry, 1900, v. 9, p. 11–33, 1901.

The section on bauxite includes figures on domestic production by States, imports, exports, and consumption, 1896–1900. The operating companies in the Alabama, Arkansas, and Georgia districts are mentioned.

7. Aluminum and alum: Mineral Industry, 1901, v. 10, p. 11–33, 1902.

The section on bauxite includes statistics on domestic production by States, imports, exports, and consumption, 1897–1901. The geologic occurrence of the

bauxite deposits in Alabama, Georgia, and Arkansas is briefly described. The deposits in California, containing 30–35 percent $Al_2O_3$, are mentioned.

8. Bauxite mining in Arkansas: Eng. Min. Jour., v. 75, p. 337, 1903.

In 1903, bauxite mining was conducted in Arkansas by the Pittsburg Reduction Co. near the town of Bauxite, Saline County. Some of the lower grade ore was washed to improve the grade. Before shipping, part of the ore was dried at about 100° C, and the remainder calcined.

9. Bauxite: Mineral Industry, 1903, v. 12, p. 37–38, 1904.

Statistics on domestic production, imports, exports, and consumption include the years 1899–1903. World production, 1896–1902, is in metric tons.

10. Bauxite: Mineral Industry, 1904, v. 13, p. 39–41, 1905.

Statistics on domestic production, imports, exports, and consumption include the years 1900–04. World production, 1900–04, is in metric tons. The geologic occurrence of bauxite in the United States is described briefly.

11. Aluminum and bauxite: U. S. Geol. Survey Min. Res. U. S., 1904, p. 285–294, 1905.

The names and locations of the companies producing aluminum both in the United States and foreign countries are given. Statistics on production and consumption of bauxite and aluminum include 1904 and previous years.

12. Mineral Industry, 1905, v. 14, p. 46–51, 1906.

Statistics are given of domestic production, total and by States, imports, exports, and consumption, 1896–1905. Analyses of 8 samples of bauxite from India are included. A section by A. J. Aubrey is entitled "The refractory uses of bauxite."

13. Bauxite: Mineral Industry, 1908, v. 17, p. 79–84, 1909.

Statistics are given of domestic production by States, imports, exports, and consumption, 1898–1908. The mining areas and operating companies in the United States are mentioned. The bauxite deposits of Austria and France are described briefly. A résumé of opinions on the chemical and mineralogic composition of bauxite is offered.

14. Bauxite: Mineral Industry, 1910, v. 19, p. 77–81, 1911.

Statistics are given of domestic production by States, imports, exports, and consumption, 1900–10. The bauxite deposits of Wilkinson County, Ga., are briefly described. These is a short section on mining in foreign countries.

15. Bauxite: Mineral Industry, 1911, v. 20, p. 92–99, 1912.

Statistics are given of domestic production by States, imports, exports, and consumption, 1901–11. Mines and operating companies are given briefly for Georgia, Arkansas, and Tennessee. There is a section on foreign bauxite deposits and mining.

16. Bauxite: Mineral Industry, 1912, v. 21, p. 86–97, 1913.

Statistics are given of domestic production by States, imports, exports, and consumption, 1902–12. Operating companies and producing areas are given for Alabama, Arkansas, Georgia, and Tennessee. A brief description of the industry in foreign countries includes Belgium, Canada, France, Germany, Italy, and Ireland. There are also sections on the uses of bauxite and alumina and the properties of bauxite.

17. Bauxite: Mineral Industry, 1915, v. 24, p. 23–29, 1916.

Statistics are given of domestic production, imports, and consumption, 1906–15, and of world production, 1911–15. The domestic bauxite industry is described by States. The bauxite deposits of India are discussed briefly.

18. Bauxite deposits of West Australia: Indus. Australian and Min. Standard, v. 64, p. 630, 1920.

The laterites of the Darling Range occur on the tops of the hills and for some distance down the slopes. The material is nodular; the highest in alumina content consists of nodules the size of peas. The deposits are about 3 feet thick in most places, but they may be as much as 6 feet thick locally. Acid soluble alumina is about 35–40 percent.

19. Bauxite in Ayrshire [Scotland]: Min. Jour., v. 128, p. 112, London, 1920.

The deposit in Ayrshire, Scotland, varies from a refractory clay to a siliceous bauxite. Chemical analyses show 26–50 percent alumina, 28–50 percent silica, 1–80 percent iron oxide, and 2–14 percent titania. This material seems to be suitable for use as a refractory, but very little of it can be considered an aluminum ore.

20. The Adriatic bauxite deposits: Min. Jour., v. 132, p. 137, London, 1921.

The great development of the bauxite deposits of Istria (Italy) and Dalmatia (Yugoslavia) during World War I is cited. The selling price was based on the percent of alumina less twice the percent of silica; first quality ore was that having a base of over 44 percent.

21. Aluminum and bauxite (1913–1919): 35 p. Imp. Min. Res. Bur., Mineral Industry, London, 1921.

22. Bauxite discovery: Min. Jour., v. 133, p. 326, London, 1921.

In the Bakony district, Hungary, the newly discovered bauxite district is estimated to contain more than 150 million tons of ore. The bauxite occurs as a deposit of uniform thickness and great extent. It lies only a few kilometers from the railroad between Veszprem and Deveczer.

23. Bauxite in Russia: Min. Jour., v. 135, p. 883, London, 1921.

This short paragraph describes the bauxite deposits 13–40 miles southwest of Tischwin [Tikhivin], Russia. The deposits were first discovered in 1882 but were not utilized until World War I. They occur as scattered pockets over an area of about 88 square miles.

24. Bauxite: Specifications and contracts: Min. Jour., v. 139, p. 986–987, London, 1922.

Although bauxite had been used for some time for the production of aluminum metal, during the previous decade [1922] there was increased demand for bauxite in new fields such as purification of oils and production of high-alumina cements. The ore is of two main types, designated the Mediterranean and the younger Tertiary. Grade and specifications of four kinds of bauxite show limits permissible in content of alumina, iron, silica, and other impurities. General sales conditions are given for France, Great Britain, and the United States.

25. Aluminum (including bauxite and cryolite), Statistics, 1919–1921: Imp. Min. Res. Bur., Mineral Industry 31 p., London, 1923.

26. The chemical industry of Jugo Slavia [bauxite]: Chem. News, v. 127, p. 131–132, 1923.

In the northern part of Yugoslavia, bauxite is mined at Ljubljana (Laiback). Bauxite also occurs in large deposits on the slopes of the Julian Alps.

27. Aluminum (including bauxite and cryolite), Statistics, 1920–1922: Imp. Min. Res. Bur., Mineral Industry, 25 p., London, 1924.

28. New bauxite deposit reported near Rome, Georgia: Manufacturers Rec., p. 84, Mar. 13, 1924.

A new bauxite deposit near Rome, Ga., has been drilled. It appears to be a vein 10 feet wide and more than 80 feet deep.

29. Bauxite from Nyasaland: Imp. Inst. Bull., v. 24, p. 731–736, London, 1926.

Bauxite was discovered in 1924 on the Luchenya Plateau and in other small areas in the Mlanje Mountains, Nyasaland. The Luchenya Plateau is a rolling grassy upland, 6,000 feet in elevation, at the head of the Luchenya River and covers an area of 2 square miles. The bauxite is 15–30 feet thick in most places. Assuming a depth of 7 feet, 20 million tons are estimated to be available. An average of eight samples showed 49.82 percent alumina, 14.02 percent iron oxide, 1.92 percent titania, 5.47 percent silica, and 28.08 percent water.

30. Supply of aluminum ore: Eng. Min. Jour., v. 123, no. 15, p. 593, 1927.

Brief editorial is concerned with the formation of bauxite, very large quantities of which will continue to be discovered in humid tropical regions, concluding that exhaustion of resources is of no concern.

31. Bauxite: Mineral Industry, 1927, v. 36, p. 21–27, 1928.

Statistics are given of domestic production by States, imports, exports, and consumption, 1917–1927, and world production by countries, 1921–1927. Brief notes on mining areas and operating companies in foreign countries are presented.

32. Bauxite deposits of France [abs.]: Quarry v. 31, p. 325–326, London, 1928.

This article is a summary of a paper by M. V. Charrin on the bauxite deposits of Brignoles, Var (Mines, carrieres, 1928). The bauxite is described as earthy to rocky, white to red in color, and oolitic, ribbonlike, or amorphous in texture. The bauxite "forms part of the Cretaceous formation, and lies directly on the Jurassic." The deposits and mines, briefly described by areas, are those at Brignoles overlain by Senonian strata of Cretaceous age, and underlain by the Kimmeridgian formation; and those of the Thornet-Vins district, which is a structural basin in which the bauxite "vein" of varying width and composition extends from the northern to the southern extremity.

33. British Guiana bauxite: Min. Mag., v. 38, p. 121–123, 2 figs. (small scale maps), London, 1928.

This paper is a résumé of "Bauxite deposits of British Guiana," by Lloyd T. Emery (*see* Emery, 5).

34. Alabama: 134 p., 29 figs., 3 pls., Ala. Indus. Devel. Board, Montgomery, 1929.

*Bauxite, p. 49–50.*—A résumé of location and types of bauxite deposits in Alabama together with paragraphs on uses, development, and the future outlook.

35. Bauxite and aluminum: U. S. Bur. Mines Min. Res. U. S., 1928, pt. 1, p. 423–427, 1930.

Statistics are given of domestic and world production and consumption of bauxite and aluminum in 1928 and previous years.

36. Laterite and laterite soils: Imp. Bur. Soil Sci. Tech. Commun. 24, 30 p., London, 1932.

This paper is a résumé of the literature covering the following phases of the origin of laterite: climatic and geologic factors affecting laterization; the formation of laterite soils; their chemical composition and classification on the basis of the silica-alumina ratio; and physical properties and fertility of these soils. A comprehensive bibliography is included.

37. Soudan: Service géol. Rapp. ann., 1932, p. 9, Dakar, 1932 [French].

Bauxite of good quality is reported to occur near Bassara, 50 kilometers south of Satadougou. Similar material occurs at Koulouba, near Baimakò, and also farther east at Quenkora, in the French Sudan.

38. Les bauxites du Soudan: Chronique mines coloniales, 2e Année, no. 11, p. 103–105, Paris, 1933.

Large deposits of very high grade white bauxite occur in French West Africa, especially in the Sudan. The traverse in 1932 showed millions of tons in the laterite deposits near Koulouba, Kita, the Bassaro plateau, M'Pébougou, along the Niger River near Gégou, and at Quenkoro. Analyzed material from M'Pébougou contained 70–75 percent alumina, 2.6–1 percent silica, 2.0–2.8 percent iron oxide, and 20–25 percent loss on ignition. From the point of view of transportation, the deposits at Koulouba and Kita are the most promising.

39. The mineral resources of British Guiana: Imp. Inst. Bull., v. 31, p. 394–396, London, 1933.

The principal mineral resources of British Guiana are gold, diamonds, and bauxite. Production of each from 1927 to 1932 is given. A short section is devoted to each commodity.

40. Mineral resources of British Guiana; *re* geological formation and surveys, previous workings, communications, transport, etc., in the Northwest District, Mazaruni and Puruni Districts, and Potaro-Essequibo Districts: British Guiana Dept. Lands and Mines pamph., 1933; rev., 83 p., British Guiana Geol. Survey, Georgetown, Demerara, 1935.

This paper is a résumé of the geology of the districts named. The mineral resources discussed are gold, diamonds, and bauxite.

Lateritization is characteristic of the surface in British Guiana, but most of it is immature. Ferruginous laterites are the usual product, with occasional bands of almost pure limonite. The formation of bauxite, in addition to the process of lateritization (decomposition and desilicification), requires the removal of iron. The known bauxite deposits fringe the zone of coastal alluvium at its junction with the basement rocks.

41. Soudan: French West Africa, Service géol. Rapp. Ann., 1933, p. 11–12, Dakar, 1933 [French].

New Bauxite deposits were discovered in the southwestern part of the Gondo plain, in the French Sudan. Because of the distance to a shipping port, these deposits are probably of little economic importance.

42. Guinée: French West Africa, Service géol. Rapp. Ann., 1935, p. 8–9, Dakar, 1935 [French].

A brief résumé of the mineral resources of French Guinea indicates that bauxite and iron are the principal economic minerals in the northwestern part of the country.

43. Sénégal: French West Africa, Service géol. Rapp. Ann., 1935, p. 7, Dakar, 1935 [French].

Bauxite deposits discovered in many places in the Fontofa region are low in iron and silica but are considered too far removed from industrial areas and shipping points to be of present commercial value.

44. Soudan: French West Africa, Service géol. Rapp. Ann., 1935, p. 14, Dakar, 1935 [French].

The discovery of bauxite deposits in the vicinity of Kita, approximate longitude 9°30′W. and latitude 13°N. is announced.

45. Bauxite, its composition, history, uses and sources: 8 p., Bauxite, Saline County, Ark., Republic Mining and Manufacturing Co., 1936.

This is a nontechnical account of the uses, sources, and processing of bauxite. The geology and mining of the Arkansas deposits are treated in detail; deposits in other countries are described briefly.

46. Sénégal: French West Africa, Service géol. Rapp. Ann., 1936, p. 9, Dakar, 1936 [French].

Laterite altered to bauxite of high quality occurs on the higher elevations between Mali and Fontofa near Sangalan. The deposits are not described in detail.

47. Côte d'Ivoire: French West Africa, Service géol. Rapp. Ann., 1937, p. 8–10, Dakar, 1937 [French].

Southwest of Lakota, in the Ivory Coast, pisolitic bauxite boulders were found in laterite. Chemical analyses showed 60 percent alumina, and about 10 percent silica plus iron oxide and titania.

48. Guinée française: French West Africa, Service géol. Rapp. Ann., 1937, p. 7, Dakar, 1937 [French].

A large area underlain by a lateritic bauxite cover near Tougue has been found to extend northeastward as far as Fontofa (Satadougou). The deposit is the result of laterization of dolerite which underlies most of the area. These bauxite deposits resemble those in northwestern Guinea, in the Boké-Koumbia area.

49. Progress report on state planning in Mississippi: 162 p., Miss. State Planning Comm. in cooperation with Natl. Res. Comm., WPA, Jan. 1, 1938.

*Bauxite, p. 107.*—Inasmuch as bauxite in Mississippi is high in both iron and silica, it is suggested that a study of its use as a source of refractory material and in aluminum cement be investigated.

50. Bauxite and copper deposits being investigated [Australia]: Eng. Min. Jour., v. 142, no. 11, p. 94, 1941.

The results of the work of a committee, appointed by the Australian Government to study the bauxite resources of the country, are stated. In New South Wales, the reserves immediately available are estimated to be 10 million tons; the important districts are near Emmaville, Inverell, and Wingello. Deposits were also investigated in Western Australia, Victoria, and Queensland.

51. Bauxita e aluminio: Brazil, Conselho Fed. Comércio Ext. Bol., Ano IV, no. 49, p. 1–5, Rio de Janeiro, 1941 [Portuguese].

World production of bauxite and aluminum in 1938 and 1939 is given by countries. Sections are included on the importance of the metal in industry and on the important producing countries. Bauxite occurs in Brazil in the States of Pará, Maranhão, Paraiba, Baía, Espírito Santo, Rio de Janeiro, Minas Gerais, and São Paulo. Reserves for the country as a whole are estimated at about 150 million tons, of which perhaps 120 million tons occur on the Poços de Caldas Plateau, and 2 million tons near Ouro Preto; that in Maranhão State is a large deposit, high in phosphorous, and occurs on Trauira Island in Maracuçumé Bay. Production and imports of bauxite in Brazil are given.

52. News of the industry, what metal statistics show: Eng. Min. Jour., v. 142, no. 4, p. 81, 1941.

Statistics are given of domestic production and imports, 1936–40; production by States or groups of States, 1940; and exports of bauxite ore and concentrates, 1939 and 1940.

53. Surinam (Dutch Guiana) increasing bauxite output: Eng. Min. Jour., v. 142, no. 12, p. 89–90, 1 fig., 1941.

Bauxite was discovered 25 years ago in the Moengo region. This mineral now (1941) represents 90 percent of the country's exports. Exports in long tons are given for selected years 1929–41.

The American bauxite interests are in the Moenga region, 104 miles up the Cottica River, the principal producing area to date. A plant is being built at

Paranam to handle ore from along the Para River and Para Creek. A Netherlands company has also built a plant near Paranam.

54. Australian bauxite: Chem. Age, v. 45, no. 1171, p. 290, London, 1941; abs., Am. Ceramic Soc. Ceramic Abs. and Bull., v. 21, no. 8, p. 176, Easton, Pa., 1942.

Large deposits of bauxite are known to occur in New South Wales. Reserves are estimated to be about 10 million tons. The location of the deposits is briefly mentioned.

55. Bauxite discovery in Hungary: Min. Jour., v. 219, no. 5592, p. 515, London, 1942.

Entire article is quoted: "October 12.—According to Vichy Radio today, quoted by Reuter, the world's richest bauxite (aluminum ore) deposits have been discovered in the mountain region of Borozeny, near Budapest. The commercial development of the workings will provide work for about 5,000 workmen."

56. Bauxite in southern India: Chem. Trade Jour., v. 3, p. 300, 1942; abs., British Ceramic Soc. Trans., v. 41, no. 2, p. 122A, 1942.

The bauxite deposits of the Shevaroy Hills are described.

57. Bauxite resources of the United States, survey by the U. S. Bureau of Mines and the U. S. Geological Survey: Mines Mag., v. 32, no. 1, p. 25, Golden, Colo., 1942.

This is a rather full résumé of the paper by J. R. Thoenen and E. F. Burchard, "Bauxite resources of the United States" (see Thoenen 1).

58. Brazil: Eng. Min. Jour., v. 143, no. 8, p. 104–105, 1942.

The Companhia Brasileira de Aluminio will soon build a 4,000-ton aluminum reduction plant at Sorocaba, near São Paulo. The company owns large deposits of high-grade bauxite in southern Minas Gerais. Another aluminum plant is also under way in Ouro Preto, Minas Gerais. Local deposits of high-grade bauxite will be used.

59. Penhalonga bauxite deposit: South African Min. Eng. Jour., v. 52, pt. 1, p. 739, 741–742, 1941; abs., Amer. Ceramic Soc. Ceramic Abs. and Bull., v. 21, no. 9, p. 198, 1942.

Bauxite was discovered north of Penhalonga, Southern Rhodesia, near the Portuguese African border. The bauxite was first mined by the Wankie Colliery but was found unsuitable for the manufacture of refractory brick. The African Explosives and Industries, Ltd., however, found that it could be easily used for the manufacture of aluminum sulfate. A chemical analysis shows 0.68 percent moisture, 5.86 percent silica, 64.91 percent alumina, 1.09 percent iron oxide, and 8.15 percent insoluble residue. The ore is mined by open-pit methods.

60. U. S. bauxite resources: Min. Mag., v. 66, no. 3, p. 90, London, 1942.

A brief review of the paper by J. R. Thoenen and E. F. Burchard, "Bauxite resources of the United States" (see Thoenen 1).

61. United States bauxite resources: Canadian Min. Jour., v. 63, no. 2, p. 110, 1942.

A résumé of the paper by J. R. Thoenen and E. F. Burchard, "Bauxite resources of the United States" (see Thoenen 1).

62. Arkansas: Eng. Min. Jour., v. 144, no. 8, p. 114, 1943.

The proposed development of a bauxite deposit under the Confederate Home in Pulaski County, Ark., is briefly discussed.

63. Brazilian aluminum: Metals and Alloys, v. 18, no. 5, p. 1264, 1943.

Bauxite occurs in 81 known deposits in Brazil. Total estimated reserves are 150 million tons.

64. Alabama—today and tomorrow: Manufacturer's Rec., v. 113, no. 8, p. 65–103, 84 figs., 1944.

Bauxite occurs in southeastern, northeastern, and northwestern Alabama and is used in the manufacture of alum, in textile work, water purification, and in paper manufacture.

65. Bauxite discovered in Pacific Northwest: Pit and Quarry, v. 36, no. 10, p. 59, 1944.

Low-grade bauxite or bauxitic clay, reported to occur in King County, Wash., may contain as much as 55 percent alumina.

66. Decline in domestic bauxite output due to three factors: Eng. Min. Jour., v. 145, no. 7, p. 91, 1944.

A table shows production, consumption, and stocks of bauxite in 1943 and 1944. Decline in production is due to the attainment of adequate stockpiles, the cutback in the aluminum program by the War Production Board, and assurance that Canada's needs could be met by South American production.

67. Brazil: Eng. Min. Jour., v. 146, no. 2, p. 186, 1945.

A new aluminum plant at Belo Horizonte started operations in January 1945. There are two installations—an alumina plant with a capacity of 20,000 tons per year, and an aluminum reduction plant with a capacity of 10,000 tons per year—together with an 8,000-kilowatt hydroelectric plant, designed and installed by International General Electric Co. The aluminum works are operated by Electro-Quimica Brasileira, S. A.

68. Mineral production in the USSR: South African Min. Eng. Jour., v. 58, pt. 2, no. 2849, p. 65–67, 1947.

The production of all minerals in the U. S. S. R., especially that of gold, is reviewed. The bauxite and aluminum industry has expanded greatly in the past few years. However, bauxite reserves, thought before World War II to amount to 45 million tons, appear to be closer to 10.6 million tons. In 1941, reserves of essentially low-grade ore are said to have been estimated to be 53 million tons. Progress in the aluminum industry "seems to have been hampered by shortage of electric power, obsolete equipment, high sulphur content in the alumina produced in blast furnace slag, and other difficulties."

69. Geological research of the Gold Coast: South African Min. Eng. Jour., v. 59, pt. 1, no. 2881, p. 245–247, 1948.

The mineral resources discussed are bauxite, muscovite mica, stibnite, clays, limestone, and ground water.

70. Mineral resources of British Guiana: South African Min. Eng. Jour., v. 58, pt. 2, no. 2867, p. 555–558, 1948.

71. Bauxietbedrijf: Suriname Geol.-Mijnbouwk. Dienst Jaarv., 1949, p. 51–54 [Dutch]. Mimeographed.

The section on bauxite gives Dutch Guiana mine production in 1949 by companies and grade of ore. The paragraphs on the two operating companies—the Billiton Mij. and the Surinaamse Bauxite Bij.—include data on number and nationality of employees and on equipment.

72. Light on Russia's post-war aluminum industry developments: Metal Bull., no. 3357, p. 7–9, 1 fig., London, Jan. 11, 1949.

This is a translation and combination of several articles published in a Zurich newspaper, "Neue Zurcher Zeitung." Sources of electrical power are said to occur near deposits of commercial grade bauxite so that aluminum [no distinction made between aluminum and alumina] factories are built near the deposits. The largest plant is at Krasniturinsk in the northern Urals; bauxite occurs nearby. The aluminum plant at Uass (Uras) is not yet completed but "70 furnace halls are already operating." There are also plants at Turinsk, West Stalinsk, and Omsk, but no local occurrence of bauxite is mentioned. Bauxite occurs at Irigiz and Boksitogorsk where there are also factories. Bauxite deposits were also discovered in mid-1947 at Kirovabad on the southeast slope of the Caucasus. A map accompanies the article.

73. A survey of the Soviet Union's non-ferrous metals industries: Metal Bull., no. 3490, p. 11–21, 10 maps, London, May 9, 1950.

The survey was made of the following industries and the sources and production of ores: aluminum, copper, lead, nickel, molybdenum, titanium, vanadium, tungsten, quicksilver, antimony, cobalt, chromium, ferromanganese, arsenic, bismuth, tin, magnesium. In the aluminum industry, the raw materials are bauxite from the Tikhvin, Ural Mountains, and Kamensk regions. The location of aluminous materials, alumina, and aluminum plants is shown on maps.

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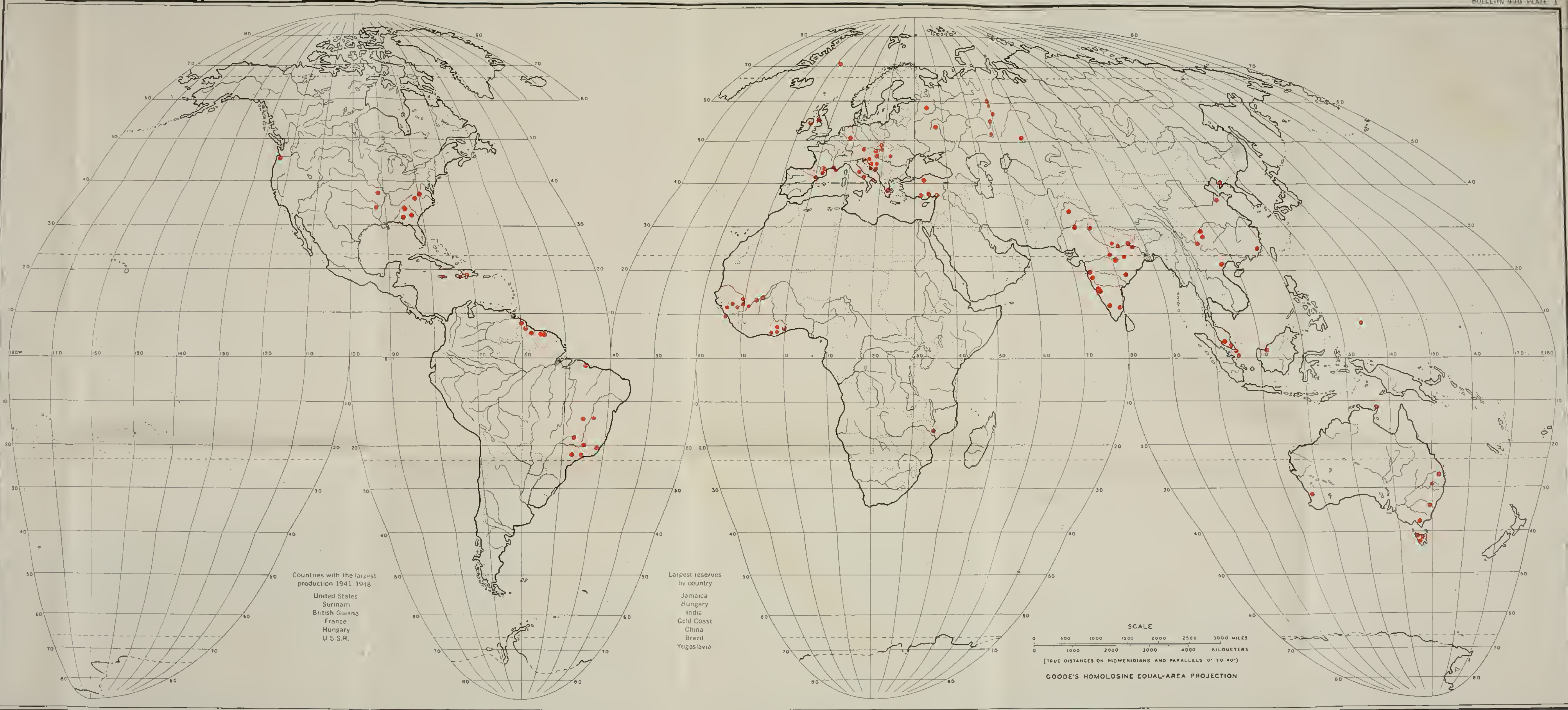




MAP SHOWING THE LOCATION OF THE PRINCIPAL BAUXITE DISTRICTS OF THE WORLD